DM562P

V.90 Integrated Data/ Fax/Voice/Speakerphone Modem Device Single Chip with Memory Built in

General Description

The DM562P integrated modem is a two-chipset design that provides a complete solution for state-of-the-art, voice-band Plain Old Telephone Switching (POTS) communication. The modem provides for Data (up to 56,000bps), Fax (up to 33,600bps), Voice and Full Duplex Speaker-phone functions to comply with various international standards.

The design of the DM562P is optimized for desktop personal computer applications, embedded microprocessor applications and Multi-Function Peripheral (MFP) FAX application. It provides a low cost, highly reliable, maximum integration, with the minimum amount of support required. The DM562P modem can operate over a dial-up network (PSTN) or 2 wire leased lines.

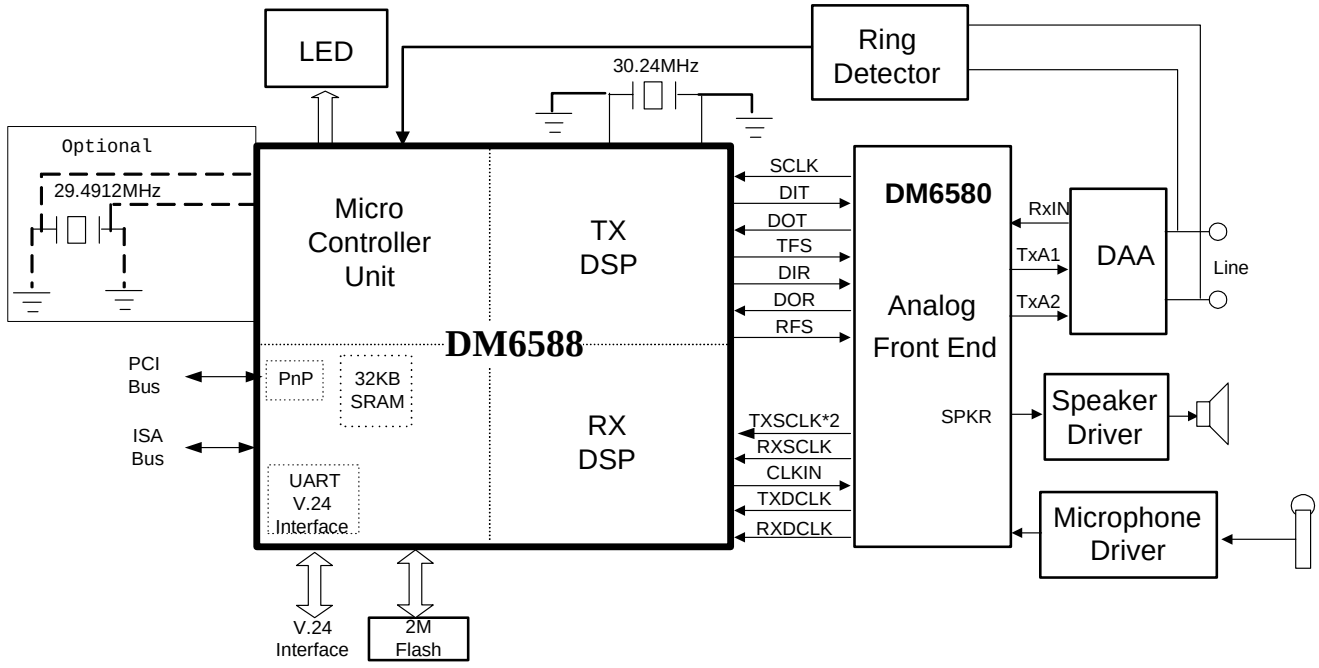
The modem integrates auto dial and answer capabilities, asynchronous data transmissions, serial and parallel interfaces, various tone detection schemes and data test modes.

The DM562P modem reference design is pre-approved for FCC part 68 and provides minimum design cycle time, with minimum cost to insure the maximum amount of success.

The simplified modem system, shown in figure below, illustrates the basic interconnection between the MCU, DSP, AFE and other basic components of a modem. The individual elements of the DM562P are:

- DM6580 Analog Front End (AFE). 48-pin LQFP package.
- DM6588 ITU-T V.90 integrated Processors with 32K bytes SRAM built in 128-pin QFP package

Block Diagram



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Features

- Data
  - ITU-T V.90 (56000 to 28000 bps)
  - ITU-T V.34 (33600 to 2400 bps)
  - ITU-T V.32bis (14400, 12000, 9600, 7200, 4800bps)
  - ITU-T V.32 (9600, 4800bps)
  - ITU-T V.22bis (2400, 1200bps)
  - ITU-T V.22 (1200bps)
  - ITU-T V.23 (1200/75bps)
  - ITU-T V.21 (300bps)
  - Bell 212A (1200bps)
  - Bell 103 (300bps)
- Fax
  - ITU-T V.17 (14400, 12000, 9600,7200bps)
  - ITU-T V.29 (9600, 7200bps)
  - ITU-T V.27ter (4800, 2400bps)
  - ITU-T V.21 Channel 2 (300bps)
  - Group III, Class 1
  - Support ECM mode
- Data Error Correction
  - MNP Class 4
  - ITU-T V.42 LAPM
- Data Compression
  - MNP Class 5
  - ITU-T V.42bis
- Voice compression
  - 4 bit ADPCM (ITU-T)
  - 2, 3 an 4 bit ADPCM (Davicom proprietary)
  - 8 Bit PCM
- DTE Interface
  - DTE speed up to 115200bps
- Enhanced “AT” command set and S registers
  - TIA/EIA 602, ITU V.25 ter AT command Set
  - TIA/EIA 602, ITU V.25 ter AT command Set
  - TIA/EIA 578 Fax Class 1 command set
  -
  - TIA/EIA IS-101 Voice command set
- Integrated UART 16550
- Parallel (ISA/PCI) and Serial (UART) interfaces
  - 6, 7 and 8 bit character support
  - Even, odd, mark and none parity detection and generation
  - 1 and 2 stop bit support
  - Auto DTE data speed detection through “AT”
- Support FSK Caller identification (Caller ID)
- Speakerphone
- Selectable world wide call progress tone detection
- Enhanced 8032 compatible micro-controller
- Power down mode
- Access up to 256K bytes external program memory
- Access up to 64K bytes external data memory
- NVRAM to store two user configurable, selectable profiles with three programmable telephone numbers
- 32K bytes SRAM built in

Parallel bus for embedded microprocessor

Compatible to ISA bus

PCI internal modem only

- PCI Plug and Play (PnP) support
- Compliant with PCI specification 2.1
- Compliant with PCI bus Power Management Interface Specification revision 1.0

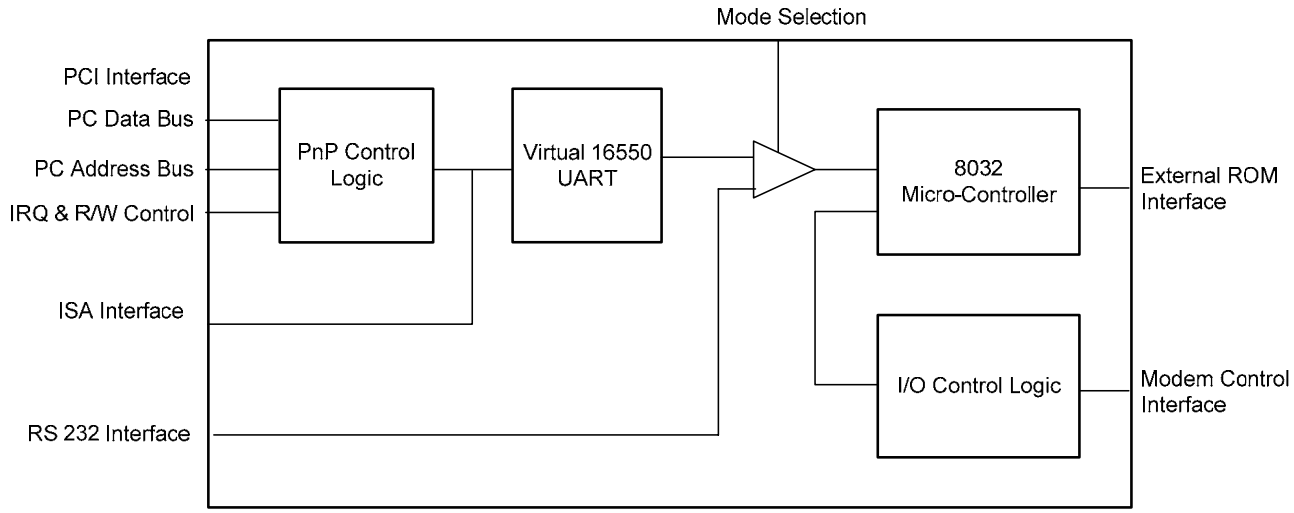
Chip 1:Integrated Processor Unit with PnP

DM6588 Description

The DM6588 Modem Control Unit is designed for use in high speed internal and external modem applications. The DM6588 incorporates a 80C32 micro-controller, a virtual 16550A UART with FIFO mode, and Plug & Play control logic.

The DM6588 MCU performs general modem control functions, and is also designed to provide Plug and Play capability for PCI bus systems.

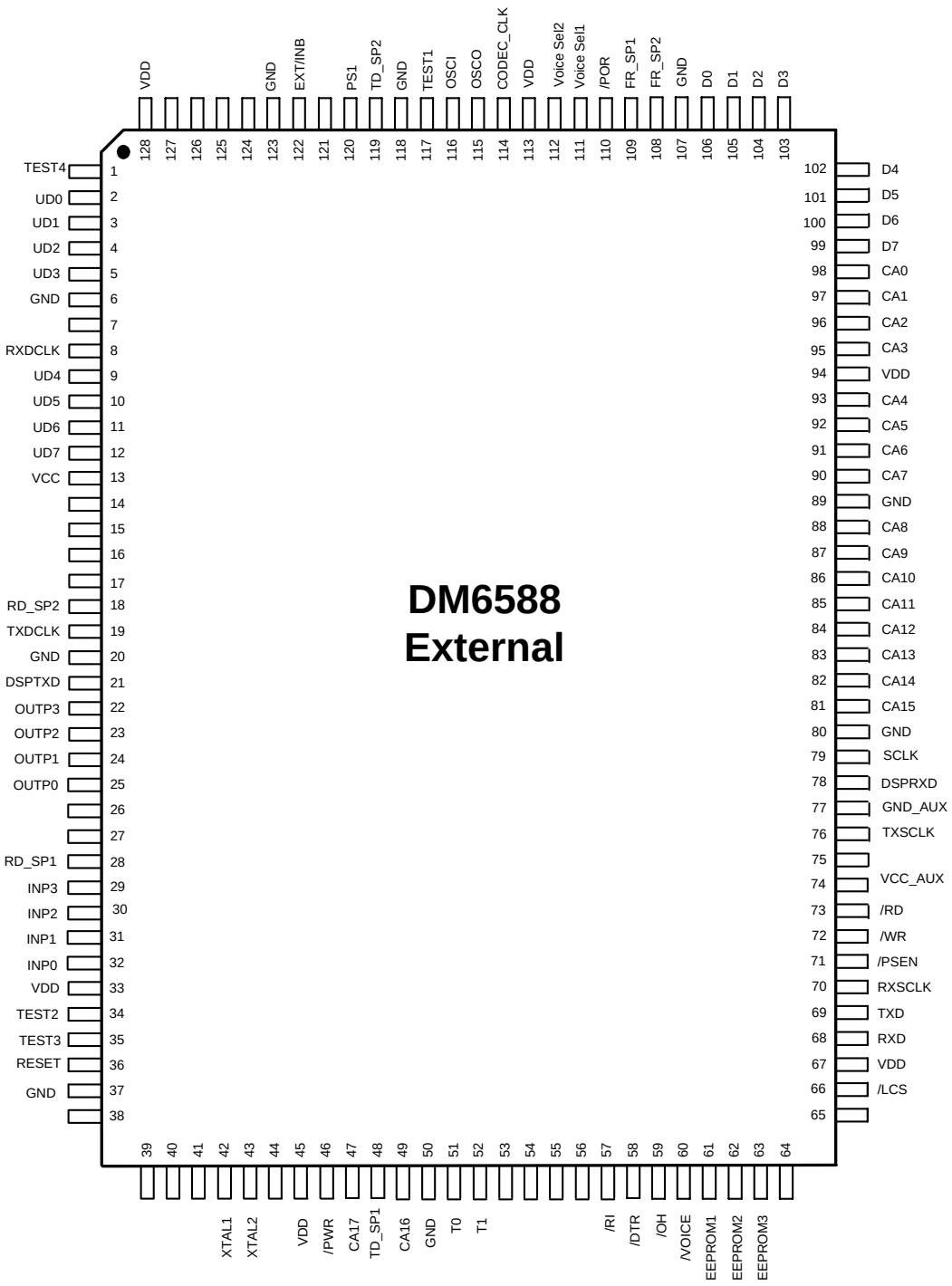
DM6588 Block Diagram



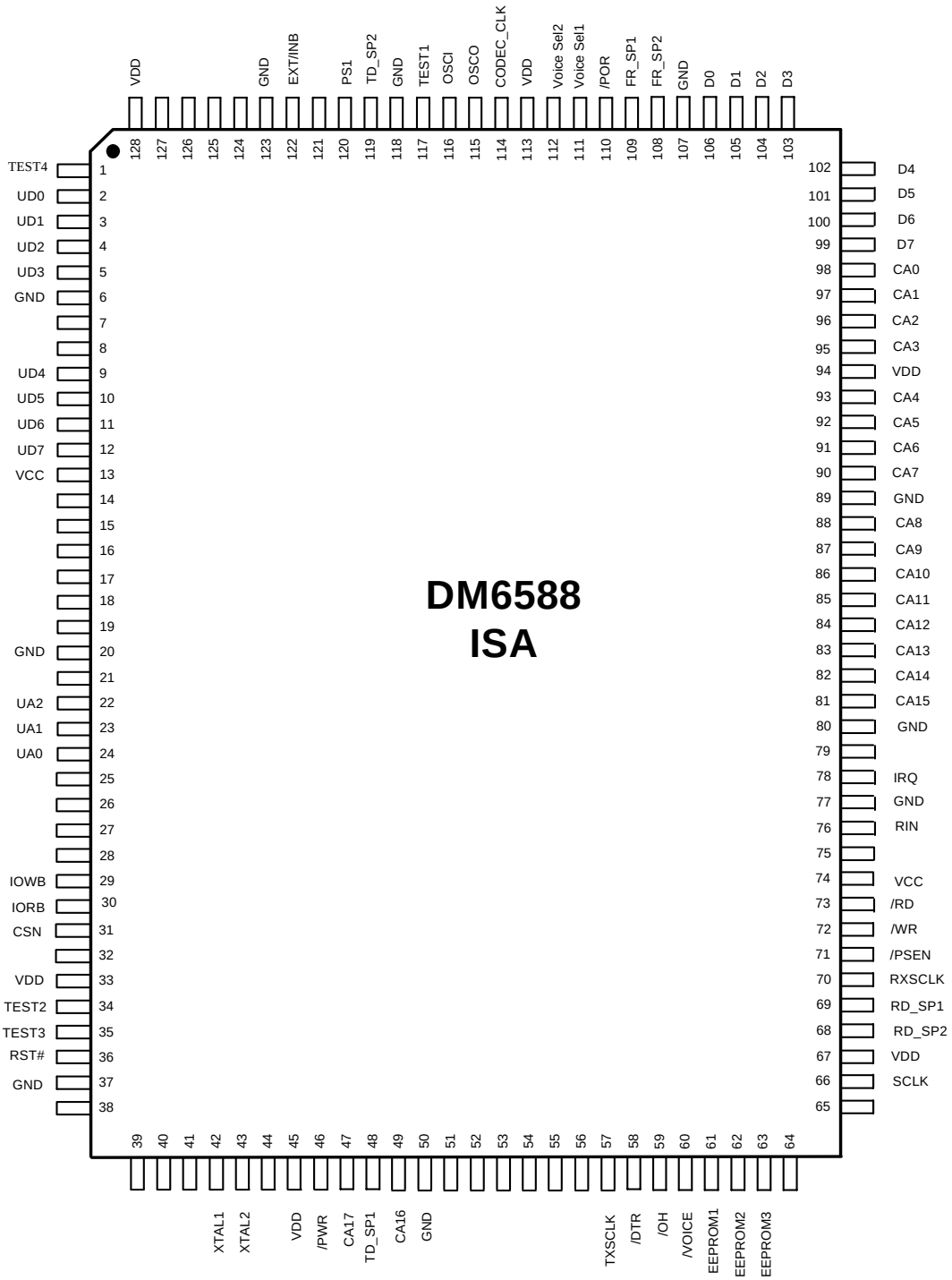
DM6588 Features

- Control interface support
- Supports parallel and serial interfaces
- Includes a 80C32 micro-controller
- 256K bytes maximum external program memory
- 64K bytes data memory built in
- Provides automatic Plug and Play or software configuration capabilities
- Virtual 16550A UART compatible parallel interface
- Fully programmable serial interface:
  - 6, 7 or 8-bit characters
  - Even, odd, mark and none parity bit generation and detection
  - 1 and 2 stop bit generation
  - Baud rate generation
  - Includes I/O control logic for modem control interface

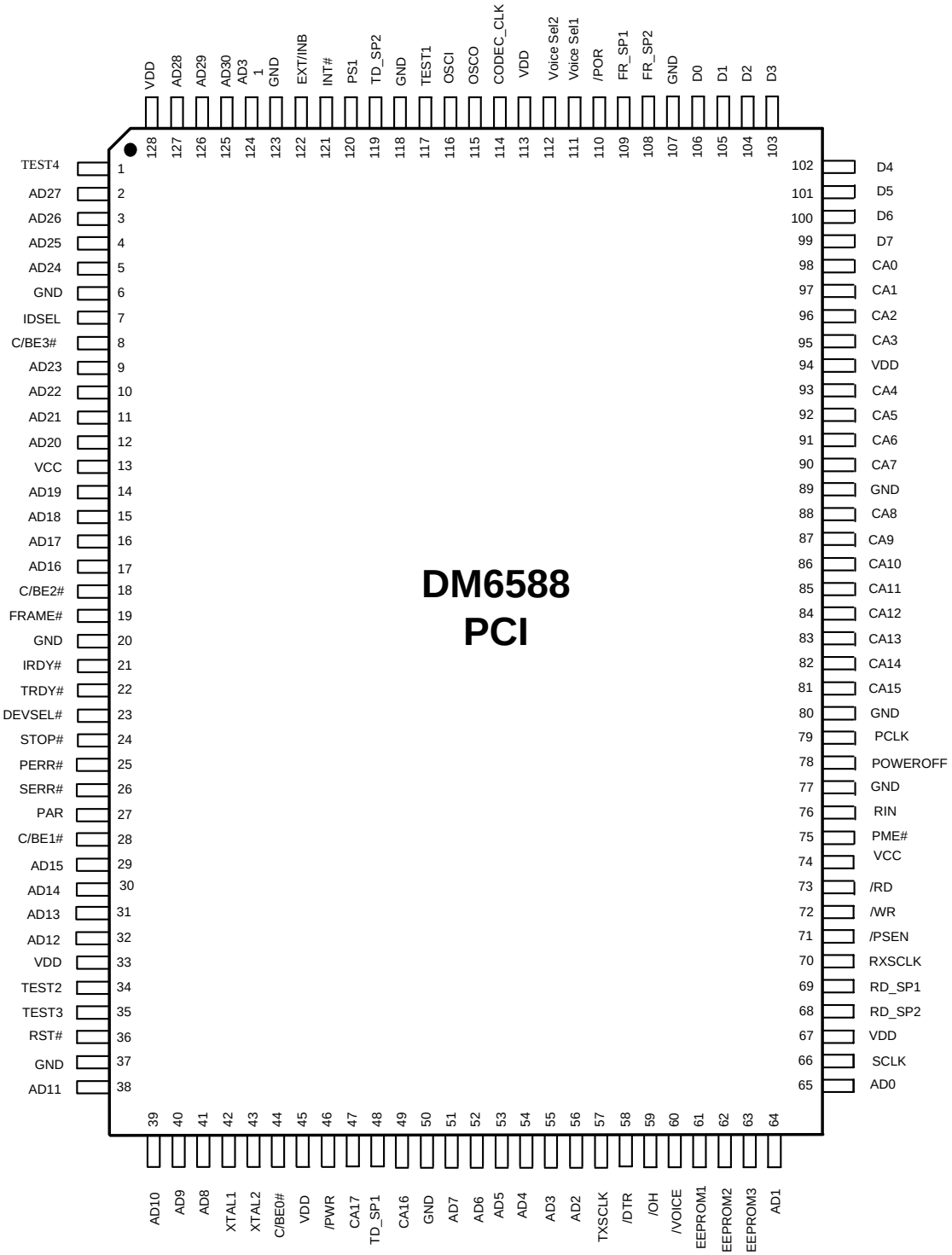
DM6588 External Pin Configuration



DM6588 ISA Pin Configuration



DM6588 PCI Pin Configuration



DM6588 Pin Description

Pin No. External	Pin No. Internal PCI	Pin No. Internal ISA	Pin Name	I/O	Description
1	1	1	TEST4	I	**Test pin 4, normal ground.** **External: N/C (low).** **PCI: N/C (low).** **ISA: connect to 3.3V.**
2,3,4,5, 9,10,11, 12			UD0 - UD7	O	**Modem Control Output**, for external modem: Memory address mapping of the controller is E800H.
8			RxDCLK	I	**Receive Data Rate Clock:(External)** This pin is used as reference clock of DSPRXD pin.
18	68	68	RD_SP2	I	**Data Input Pin Of The Serial Port 2:** The serial data is sampled at the falling edge of the SCLK. The MSB is coming immediately after the falling of FR_SP2 signal.
19			TXDCLK	I	**Transmit Data Rate Clock:(External)** This pin is used as reference clock of DSPTXD pin.
21			DSPTxD	I	**Modem Transmit Data (External)** Shifted into DM6581/DM6582 from EIA port through this pin at the rising edge of TXDCLK.
28	69	69	RD_SP1	I	**Data Input Pin Of The Serial Port 1:** The serial data is sampled at the falling edge of the SCLK. The MSB is coming immediately after the falling of FR_SP1 signal.
6,20,37 50,77,80, 89,107, 118,123	6,20,37 50,80,89 107,118, 123	6,20,37 50,77,80, 89,107, 118,123	GND	P	**Ground**
22, 23, 24, 25			OUTP3, OUTP2, OUTP1, OUTP0	O	**Modem Control Output** For external modem, these pins are bit7~4 of the modem control output. Memory address mapping of the controller is C800H.
29, 30, 31, 32			INP3, INP2, INP1, INP0	I	**Modem Control Input:(External)** These pins are bit3~0 of the modem control input. Memory address mapping of the controller is C800H.
33,45 67,94, 113,128	33,45, 67,94, 113,128	33,45, 67,94, 113,128	VDD	P	**+3.3V Power Supply**
13,74	13,74	13,74	VCC	P	**+2.5V Power Supply**
34	34	34	TEST2	I	**Test pin 2,normal ground**
35	35	35	TEST3	I	**Test pin 3,normal ground**
36			RESET	I	**Reset:** An active high signal used to reset the DM6588.
42	42	42	XTAL1	I	**Crystal Oscillator Input**

43	43	43	XTAL2	O	**Crystal Oscillator Output**
46	46	46	/PWR	O	**Controller Program Write Enable:** This pin is used to enable FLASH ROM programming.
48	48	48	TD_SP1	O	**Data Output Pin Of Serial Port 1** The serial data is clocked out through this pin according to the rising edge of SCLK. The MSB is sent immediately after the falling edge of the FR_SP1 signal.
49 47	49 47	49 47	CA16 CA17	O	**Bank Switch Control:** These signals are used to switch external program memory between banks. Bank 0: CA16=0, CA17=0 Bank 1: CA16=1, CA17=0 Bank 2: CA16=0, CA17=1 Bank 3: CA16=1, CA17=1
51			T0	I	**Controller Counter 0 Input**
52			T1	I	**Controller Counter 1 Input**
57	76	76	/RI	I	**Ring Signal Input**
76	57	57	TxSCLK*2	I	**TxDSP Interrupt 1 Input**
58	58	58	/DTR	I	**DTR Input Pin (P1.1)**
59	59	59	/OH	O	**Hook Relay Control (P1.2)**
60	60	60	/VOICE	O	**Voice Relay Control. Modem Control Output** (memory map is bit 3 of DAA at memory address D000H)
61-63	61-63	61-63	EEPROM 1-3	I/O	**EEPROM Control Pins (P1.4-P1.6)**
66			/LCS	I	**Loop Current Detection. Modem Input Control:** This pin is mapped to bit0 of address D000H.
79	66	66	SCLK	I	**Reference Clock For Serial Port 1 And Serial Port 2**
68			RXD	I	**Controller Serial Port Data Input**
69			TXD	O	**Controller Serial Port Data Output**
70	70	70	RxSCLK	I	**Rx DSP Interrupt 3 Input**
71	71	71	/PSEN	O	**Controller Program Store Enable:** This output goes low during a fetch from external program memory.
72	72	72	/WR	O	**Controller External Data Memory Write Control**
73	73	73	/RD	O	**Controller External Data Memory Read Control**
78			DSPRxD	O	**Modem Received Data :(External)** Shifted out to the EIA port through this pin according to the rising edge of RXDCLK.
117	117	117	TEST1		**Test pin 1, normal ground**
81,82, 83,84, 85,86, 87,88	81,82, 83,84, 85,86, 87,88	81,82, 83,84, 85,86, 87,88	CA15,CA14, CA13,CA12, CA11,CA10, CA9,CA8	O	**Controller Address Bus**
90,91,	90,91,	90,91,	CA7 - CA0	O	**Controller Address Bus**

92,93, 95,96, 97,98	92,93, 95,96, 97,98	92,93, 95,96, 97,98			
99,100, 101,102, 103,104, 105,106	99,100, 101,102, 103,104, 105,106	99,100, 101,102, 103,104, 105,106	D7,D6, D5,D4, D3,D2, D1,D0	I/O	**Controller Data Bus**
108	108	108	FR_SP2	I/O	**Frame Signal Of Serial Port 2**
109	109	109	FR_SP1	I/O	**Frame Signal Of Serial Port 1**
110	110	110	/POR	O	**DSP Reset Output**
111 112	111 112	111 112	VOICE Se1 1 VOICE Se1 2	O	**Modem Control Output** Memory map is bit 1-2 of DAA at memory address D000H
114	114	114	CODEC_CLK	O	**20.16MHz Clock Output For DM6580 Chip**
115	115	115	OSCO	O	**Optional Codec X'tal clock output**
116	116	116	OSCI	I	**Optional Codec X'tal clock input**
117	117	117	TEST1	I	**Test pin 1,normal ground**
119	119	119	TD_SP2	O	**Data Output Pin Of Serial Port 2** The serial data is clocked out through this pin according to the rising edge of SCLK. The MSB is sent immediately after the falling edge of the FR_SP2 signal.
120	120	120	PS1	O	**Modem Control Port Select Output:** Memory address mapping of the controller is D800H.
122	122	122	EXT/INTB	I	**Select Pin:** Used to select internal or external operation. 0: internal modem, PCI or ISA. 1: external modem
7,14,15, 16,17,26, 27,38,39, 40,41,44, 53,54,55, 56,64,65, 75,121, 124,125, 126,127		7,8, 14,15,16, 17,21,25, 26,27,28, 32,38,39, 40,41,44, 51,52,53, 554,55,56, 64,65,75, 79,121, 124,125, 126,127	NC	N	**NC**

DM6588 Pin Description-ISA Interface only

Pin No.	Pin Name	I/O	Description
2-5, 9-12	UD0-UD3, UD4-UD7	I/O	**Data Bus Signal:** These signals are connected to the data bus of the PC (or Host) I/O. They are used to transfer data between the PC and the DM6588.
22-24	UA0-UA2	I	**System Address:** These signals are connected to the bus of PC (or Host) I/O. They are used to select the DM6588 offset UART I/O address.
29	/IOWB	I	**I/O Write:** An active low input signal used to write data to the DM6588.
30	/IORB	I	**I/O Read**: An active low input signal used to read data from the DM6588.
31	/CSN	I	**Address Enable:** This is an active low signal to enable the system address for DM6588.
36	/RST	I	**Reset:** An active low signal used to reset the DM6588.
78	IRQ	O	**Interrupt Request:** The active pin will go high when an interrupt request is generated from the DM6588.

DM6588 Pin Description-PCI Interface only

Pin No.	Pin Name	I/O	Description
78	POWEROFF	O	**Power Off when high**
121	INT#	O	**PCI Interrupt Request** This signal will be asserted low when an interrupt condition as defined in CR5 is set and the corresponding mask bit in CR7 is not set.
79	PCLK	I	**PCI System Clock** This signal is the PCI bus clock that provides timing for all bus phases. The frequency is 33MHz.
75	PME#	O	**Power Management Event** The signal indicates that a power management event.
124-127,2-5 9-12,14-17 29-32,38-41 51-56,64,65	AD31-AD0	I/O	**PCI Address & Data Bus** These are the multiplexed address and data signals. DM6588 will decode each address on the bus and respond if it is the target being addressed.
7	IDSEL	I	**Initialization Device Select** For the accesses to the configuration address space, the device select Decoding is done externally and is signaled via this pin. This signal is asserted high during configuration read and write access.
8 18 28 44	C/BE3# C/BE2# C/BE1# C/BE0#	I	**PCI Bus Command/Byte Enable** During the address phase, these signals define the bus command or the type of the bus transaction that will take place. During the data phase, these pins indicate which byte lanes contain valid data. C/BE0# applies to bit7~0 and C/BE3# applies to bit 31~24.
19	FRAME#	I	**PCI Cycle Frame** This signal is driven low by the master to indicate the beginning and duration of a bus transaction. It is deasserted when the transaction is in its final phase.
21	IRDY#	I	**PCI Initiator Ready** This signal is driven low when the master is ready to complete the current data phase of the transaction. A data phase is completed on any clock both IRDY# and TRDY# are sampled asserted.
22	TRDY#	I/O	**PCI Target Ready** This signal is driven low when the target is ready to complete the current data phase of the transaction. During a read, it indicates that the valid data is asserted. During write, it indicates that the target prepares to accept data.
23	DEVSEL#	I/O	**PCI Device Select** DM6588 asserts the signal low when it recognizes its target address after FRAME# is asserted.
24	STOP#	I/O	**PCI Stop** This signal is asserted low by the target device to request the master device to stop the current transaction.
25	PERR#	I/O	**PCI Parity Error** DM6588 will assert this signal low to indicate a parity error on any incoming data.
26	SERR#	O	**PCI System Error** This signal is asserted low when an address parity is detected with PCICS bit31 enabled. The system error asserts two clock cycles after the address if an address parity error is detected.

27	PAR	I/O	**PCI Parity** This signal indicates even parity across AD0~AD31 and C/BE0#~C/BE3# including the PAR pin. It is stable and valid one clock after the address phase.
36	RST#	I	**Reset:** An active low signal used to reset the DM6588.
76	RIN	I	**Ring Signal Input for Auxiliary Power**
77	GND_AUX	P	**Auxiliary Ground**

DM6588 Functional Description

1. Operating Mode Selection

The DM6588 can be used in internal or external modem applications. When operating as an internal modem, the EXT/INTB input (pin 122) must be attached to ground, and vice versa (VDD) when operating as an external modem.

External mode is operated with host by UART. Internal mode can support parallel (ISA) and PCI interface to host. The TEST4 input (pin 1) is for ISA or PCI selection.

2. Micro-controller Program Memory

The DM6588 supports two bank switch control pins to switch external program memory among four banks. The DM6588 can access a total of 256K of external program memory.
Address mapping:

bank0: 00000H - 0FFFFH
bank1: 10000H - 1FFFFH
bank2: 20000H - 2FFFFH
bank3: 30000H - 3FFFFH

For bank switching, three instructions must be included in software.

Switch to bank1:

```
CLR     P1.3
SETB    P1.7
JMP     BANK 1 ADDRESS
```

Switch to bank2:

```
CLR     P1.7
SETB    P1.3
JMP     BANK 2 ADDRESS
```

Switch to bank3:

```
CLR     P1.7
CLR     P1.3
JMP     BANK 3 ADDRESS
```

Return to bank 0:

```
SETB    P1.7
SETB    P1.3
JMP     BANK 0 ADDRESS
```

* For detailed information about the micro-controller, refer to the *Programmer's Guide to 8032.*

3. Micro-controller Power Down Mode

An instruction that sets the register PD (PCON.1) will cause the 80C32 to enter power down mode. There are three ways to wake up the 80C32
(1) Positive pulse signal occurring at the reset pin of the 80C32
(2) Negative pulse occurring at /RI (P1.0) of the 80C32
(3) Programming the PnP Wake Up Controller Register.

4. Enhanced Internal Direct Memory

There are two 128 byte banks of internal direct memory in the 80C32. The system uses the lower 128 bytes under normal conditions. Switching to the upper bank is achieved by loading register 8FH.1 (SFR of the 80C32) with 1. Switching to the lower bank can be achieved by loading the same register with 0.

5. Re-flash Program Memory

By setting 8FH.2 the system can switch program and data memory. If the system uses FLASH memory as program memory this function is used to re-flash program code by downloading the program to data memory then switching them.

Example:

```
SETB    8FH.2
LJMP    0000H
```

6. Micro-controller I/O Description

MODEM expansion port: Address C800H (external only)

Bit7	Bit6	bit5	bit4	bit3	bit2	bit1	bit0
OUT P3	OUT P2	OUT P1	OUT P0	INP3	INP2	INP1	INP0

Bit0 to Bit3: read only

Bit4 to Bit7: write only

Modem Output Port 1 Register: Address D000H

Write only

Bit7	bit6	bit5	bit4	Bit3	bit2	bit1	bit0
				/Voice	Voice -sel2	Voice -Sel1	/POR

These 4 bits control the DM6588 output ports.

Modem Output Port 2 Register: Address D800H

Write only

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
					/MUTE	/PULSE	/CID

These 3 bits control the DM6588 output ports.

Memory Mapping of Micro-controller 80C32 :

Address	Description	External	Internal
C800H	GPIO OUTP3-OUTP0(Bit7~4);INP3~INP0(Bit3~0)	Y	N
D000H	DAA Port	Y	Y
D400H	UART Clock Register	N	Y
D800H	PS1 Port (Modem hybrid circuit control port)	Y	Y
DC0XH	HDLC registers	Y	Y
E000H	Modem UART Status Register	N	Y
E400H	/RUCS Port(RX DSP Dual Port Registers)	Y	Y
E800H	Modem LED Output Port UD7~UD0	Y	N
EC00H	UART Baud Generator Divisor Latch Register	N	Y
F000H	/TUCS Port (TX DSP Dual Port Register)	Y	Y
F80XH	PCI Vender & Device ID Port Register	N	Y

7. HDLC Description

HDLC RxDataBits Register: Address DC00H

Write only
Once the RxDataBit set to 1, the data in the RxBuffer will be transferred to RxFIFO. The transfer bit number is the same as the programming value of RxDataBits Register.

HDLC RxBuffer: Address DC01H

Write only
Receive data will be written to the RxBuffer and will be input to the RxHDLC circuit. The RxBuffer is 16 bytes wide.

HDLC RxFiFo: Address DC01H

Read only
After the data has been passed from the RxBuffer to the RxHDLC circuit, the RxHDLC circuit will remove the 7eH patterns and transfer the results to the RxFIFO. There RxFIFO is 21 bytes wide.

HDLC TxDataBits Register: Address DC02H

Write only
Data written to TxDataBits will be presented to the TxFIFO. The data in TxFIFO will be transferred to TXHDLC circuit. The transfer bit number is the same as the value of TxDataBits register. If the TxFIFO is empty , a 7e pattern will be loaded to the TxFIFO. If TxFIFO is not empty and the data frame has the pattern of five consecutive "1" , then the TXHDLC circuit will insert "0" automatically.

HDLC TxFiFo Register: Address DC03H

Write only
The original HDLC frame data will be loaded to the TxFIFO, presented to the input of the TxHDLC circuit. The TxFIFO is 21 bytes wide.

HDLC TxBuffer: Address DC03H

Read only
According to TxDataBits, the TxHDLC circuit will transfer the same number data bits to the TxBuffer. The TxBuffer is 16 bytes wide.

HDLC CNTL/STATUS Register: Address DC04H

Bit0:TxReady0
0: indicates the data in the TxFIFO has deceased to zero and the HDLC circuit has transferred the 1st 7eH pattern.
1:indicates that the TxFIFO data is greater than or equal to the threshold value.

Bit1:Rxdata
0: all the data in the RxBuffer has been read.
1:Programed by software to indicate that all data in the RxDataBits register has been written to the RxBuffer.

Bit2:TxFIFO Threshold
0: TxFIFO threshold No. = 11
1: TxFIFO threshold No. =16

Bit3:TxFiFo Status
0:data No. in TxFIFO >= threshold
1:data No. in TxFIFO <= threshold

Bit4:Txdata
0:A write action to TxDataBites register will clear this bit.
1:Bit No. in TxBuffer = TxDataBits register.

Bit5: RxFIFO empty
0:data bytes No. in RxFIFO <>0
1:data bytes No. in RxFIFO = 0

Bit6: Reset
0:Normal state
1:reset HDLC circuit

Zero Deletion In _ buffer register: Address DC08H

write only
Controller write the original data to this temp buffer.

Zero Deletion Out _ buffer register: Address DC08H

read only
Controller read the result data from this buffer

Zero Deletion Status/Rst register: Address DC09H

Bit0: data ready flag (read only)
1:data has been load to out _ buffer. (clear automatically by a read from out_ buffer)
0: data has not been load to out _ buffer.
Bit1: frame end flag (read only)

1:Indicate end of HDLC frame (clear by a reset action)

Bit2: fram ready flag (read only)
1:CRC check ok.
0:CRC check fail.
Bit3: In _ buffer empty flag
1:In _ buffer empty (clear automatically by a write to In _buffer)
0:In _ buffer not empty
Bit7: reset bit (write only)
1:software reset

CRCL register: Address DC0AH (read only)

CRCH register: Address DC0BH (read only)

8. Micro-controller Control Register for Internal Mode

UART Clock (internal mode only)

The internal clock of the virtual UART logic is fixed at 1.8432MHz. The clock is derived from an external 30MHz crystal. The UART 1.8432MHz clock will be obtained by division. When the operating frequency of the DM6588 controller changes, the divider should be changed accordingly. This divider is specified by the Configuration Register which can be written by the DM6588 controller. The address mapping of the register is D400H: (DM6588 controller memory mapping)

Bit 0: Always 0.

Bit 6-1: define the clock divider range from 2 to 64 (even number).

Bit 7: Not used.

UART Clock Register: (**internal mode only)**
Address D400H Reset State: 06H
Write Only

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
X	dat6	dat5	dat4	dat3	dat2	dat1	0

UART Baud Generator Divisor Latch Register: Address EC00H (internal mode only)

Read only

bit7	bit6	bit5	bit4	bit3	Bit2	bit1	bit0
dat7	dat6	dat5	dat4	dat3	Dat2	dat1	dat0

By reading this register, the micro-controller can monitor the value of the low byte divisor latch of the virtual UART baud generator (see DLL in next section) and determine the baud rate clock itself.

Modem Status Control Register (MSCR): Address E000H (internal mode only)

Write only

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	/CTS	/DSR	/DCD	/RI

This register contains information about the line status of the modem. The available signals are Ring Detect (/RI), Carrier Detect (/DCD), Data Set Ready (/DSR) and Clear To Send (/CTS).

9. Host Control Register for Virtual 16550A UART (internal mode only)
Receiver Buffer (Read), Transmitter Holding Register (Write): Address: 0 (DLAB=0)

Reset State 00h

bit7	bit6	bit5	bit4	bit3	Bit2	bit1	Bit0
dat7	dat6	dat5	dat4	dat3	Dat2	dat1	Dat0

When this register address is read, it contains the parallel received data. Data to be transmitted is written to this register.

Interrupt Enable Register (IER): Address 1

Reset State 00h, Write Only

bit7	Bit 6	bit 5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	Enable Modem Status Intr	Enable Line Status Intr	Enable TX Holding Register Intr	Enable RX Data Intr

This 8-bit register enables the four types of interrupts as described below. Each interrupt source can activate the INT output signal if enabled by this register. Resetting bits 0 through 3 will disable all UART interrupts.

Bit 0: This bit enables the Received Data Available

and timeout interrupts in the FIFO mode when set to logic 1.

Bit 1: This bit enables the Transmitter Holding Register Empty Interrupt when set to logic 1.

Bit 2: This bit enables the Receiver Line Status Interrupt when set to logic 1.

Bit 3: This bit enables the MODEM Status Interrupt when set to logic 1.
Bit 4-7: Not used

Interrupt Identification Register (IIR): Address 2

Reset State 01h, Read only

Bit7	Bit6	bit5	bit4	bit3	bit2	bit1	bit0
FIFO Enable	0	0	0	D3: INTD2	D2: INTD1	D1: INTD0	D0: int Pending

In order to provide minimum software overhead during data transfers, the virtual UART prioritizes interrupts into four levels as follows: Receiver Line Status (priority 1), Receiver Data Available (priority 2), Character Timeout Indication (priority 2, FIFO mode only), Transmitter Holding Register Empty (priority 3), and Modem Status (priority 4).

The IIR register gives prioritized information regarding the status of interrupt conditions. When accessed, the IIR indicates the highest priority interrupt that is pending.

Bit 0: This bit can be used in either a prioritized interrupt or polled environment to indicate whether an interrupt is pending. When this bit is a logic 0, an interrupt is pending, and the IIR contents may be used as a pointer to the appropriate interrupt service routine. When bit 0 is a logic 1, no interrupt is pending, and polling (if used) continues.

Bit 1-2: These two bits of the IIR are used to identify the highest priority interrupt pending, as indicated in the table below.

Bit 3: In character mode, this bit is 0. In FIFO mode, this bit is set, along with bit 2, when a timeout interrupt is pending.
Bit 4-6: Not used

Bit 7: FIFO always enabled.

Interrupt Identification Register (IIR): Address 2 (continued)

D3	D2	D1	D0	Priority Level	Interrupt Type	Condition	Reset
0	0	0	1	-	-	-	-
0	1	1	0	Highest	Receiver Line Status	Overrun Error, Parity Error, Framing Error or Break Interrupt	Reads the Line Status Register
0	1	0	0	Second	Receiver Data Available	Receiver Data Available or Trigger Level Reached	Reads the Receiver Buffer Register or the FIFO has Dropped Below the threshold value
1	1	0	0	Second	Character Timeout Indication	No characters have been read from or written to the Rx FIFO during programming time interval, and the Rx FIFO is not empty	Reads The Receiver Buffer Register
0	0	1	0	Third	Transmitter Holding Register Empty	Ready to accept new data for transmission	Reads the IIR Register or (if source of interrupt) Writes To The Transmitter Holding Register
0	0	0	0	Fourth	Modem Status	Clear to Send, Data Set Ready, Ring Indicator or Data Carrier Detected	Reads the Modem Status Register

FIFO Control Register (FCR): Address 2

Reset State 00h , write only

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
RCVR Trig (MSB)	RCVR Trig (LSB)	0	0	DMA Mode	TxFIFO Reset	RxFIFO Reset	FIFO Enable

This is a write only register at the same location as the IIR, which is a read only register. This register is used to enable the FIFOs, clear the FIFOs, set the RxFIFO trigger level, and select the type of DMA signal.

Bit 0: FIFO Enable, This bit is always high

Bit 1: Writing a 1 to FCR1 clears all bytes in the RxFIFO and resets the counter logic to 0.

Bit 2: Writing a 1 to FCR2 clears all bytes in the TxFIFO and resets the counter logic to 0.

Bit 3: Setting FCR3 to 1 will cause the RXRDY and TXRDY pins to change from mode 0 to mode 1 if FCR0 = 1.

Bit 4-5: Reserved

Bit 6-7: FCR6, FCR7 are used to set the trigger level for the RxFIFO interrupt.

FCR7	FCR6	RxFIFO Trigger Level
0	0	01
0	1	04
1	0	08

Line Control Register (LCR): Address 3

Reset State 00h, Write Only

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
DLAB	SBRK	STP	EPS	PEN	STB	WLS1	WLS0

This register is available to maintain compatibility with the standard 16550 register set, and provides information to the internal hardware that is used to determine the number of bits per character.

WLS1	WLS0	Word Length
0	0	5 bits
0	1	6 bits
1	0	7 bits
1	1	8 bits

Bit 0-1: WLS0-1 specifies the number of bits in each transmitted and received serial character.

Bit 2: STB specifies the number of stop bits in each transmitted character. If bit 2 is a logic 0, one stop bit is generated in the transmitted data. If bit 2 is a logic 1 when a 5-bit word length is selected via bits 0 and 1, one and a half stops are generated. If bit 2 is a logic 1 when either a 6-, 7- or 8-bit word length is selected, two stop bits are generated. The Receiver checks the first Stop-bit only, regardless of the number of Stop bits selected.

Bit 3: Logic 1 indicates that the PC has enabled parity generation and checking.

Bit 4: Logic 1 indicates that the PC is requesting an even number of logic 1s (even parity generation) to be transmitted or checked. Logic 0 indicates that the PC is requesting odd parity generation and checking.

Bit 5: When bits 3, 4 and 5 are logic 1, the parity bit is transmitted and checked by the receiver as logic 0. If bits 3 and 5 are 1 and bit 4 is logic 0, then the parity is transmitted and checked as logic 1.

Bit 6: This is a Break Control bit. When it is set to logic 1, a break condition is indicated.

Bit 7: The Divisor Latch Access bit must be set to logic 1 to access the Divisor Latches of the baud generator during a read or write operation. It must be set to logic 0 to access the Receiver Buffer, the Transmitter Holding Register, or the Interrupt Enable Register.

Modem Control Register (MCR): Address 4

Reset State 00h

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	0	0	RTS	DTR

Bit 0: This bit asserts a Data Terminal Ready condition that is readable via port P1.1 of the micro-controller 80C32. When bit 0 is set to logic 1, the P1.1 is forced to logic 0. When bit 0 is reset to logic 0, the P1.1 is forced to logic 1.

Bit 1: This bit asserts a Request To Send condition that is readable via port P3.4 of the micro-controller 80C32. When bit 1 is set to logic 1, the P3.4 is forced to logic 0. When bit 1 is reset to logic 0, the P3.4 is forced to logic 1.

Line Status Register (LSR): Address 5

Reset State 60h, Read only

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
RCV	ETEMT	THRE	BI	FE	PE	OE	DR

This register provides status information to the host PC concerning character transfer. Bit 1-4 indicates error conditions that produce a Receiver Line Status interrupt whenever any of the corresponding conditions are detected. The Line Status Register is valid for read operations only.

Bit 0: Set to logic 1 when a received character is available in the RxFIFO. This bit is reset to logic 0 when the RxFIFO is empty.

Bit 1: An Overrun error will occur only after the RxFIFO is full and the next character has overwritten the unread FIFO data. This bit is reset upon reading the Line Status Register.

Bit 2: A logic 1 indicates that a received character does not have the correct even or odd parity as selected by the Parity Select bit. This error is set when the corresponding character is at the top of the RxFIFO. It will remain set until the CPU reads the LSR.

Bit 3: This bit is the Framing Error (FE) indicator. Bit 3 indicates that the received character did not have a valid stop bit. Bit 3 is set to a logic 1 whenever the stop bit following the last data bit or parity bit is detected as a zero bit (spacing level). The FE bit is reset whenever the CPU reads the contents of the Line Status Register. The FE error condition is associated with the particular character in the FIFO to which it applies. This error is revealed to the CPU when its associated character is at the top of the FIFO.

Bit 4: This bit is a Break Interrupt (BI) indicator. Bit 4 is set to logic 1 whenever the received data input is held in the Spacing (logic 0) state for longer than a full word transmission time (that is, the total time of Start bit + data bits + Parity + Stop bits). The BI indicator is reset whenever the CPU reads the contents of the Line Status Register. The BI error condition is associated with the particular character in the FIFO to which it applies. This error is revealed to the CPU when its associated character is at the top of the FIFO.

Bit 5: This bit is a Transmitter Holding Register Empty indicator. Bit 5 indicates that UART is ready to accept a new character for transmission. In addition, this bit causes the UART to issue an interrupt to the CPU when the Transmit Holding Register Empty Interrupt Enable is set high. The THRE bit is reset to logic 0 when the host CPU loads a character into the Transmit Holding register. In the FIFO mode, this bit is set when the TxFIFO is empty, and is cleared when at least 1 byte is written to the TxFIFO.

Bit 6: This bit is the Transmitter Empty indicator. Bit 6 is set to a logic 1 whenever the Transmitter Holding Register (THR) is empty, and is reset to a logic 0 whenever the THR contains a character. In FIFO mode, this bit is set to 1 whenever the transmit FIFO is empty.

Bit 7: In character mode, this bit is 0. In FIFO mode, this bit is set when there is at least one parity error, framing error, or break indication in the FIFO. If there are no subsequent errors in the FIFO, LSR7 is cleared when the CPU reads the LSR.

Modem Status Register (MSR): Address 6

Reset State bit 0-3 : low , bit 4-7: Input Signal

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
DCD	RI	DSR	CTS	DDCD	TERI	DDSR	DCTS

This 8-bit register provides the current state of the control lines from the Modem to the CPU. In addition, four bits of the Modem Status Register provide change information. These bits are set to a logic 1 whenever a control input from the Modem changes state. They are reset to logic 0 whenever the CPU reads the Modem Status Register.

Bit 0: This bit is the Delta Clear to Send (DCTS) indicator. Bit 0 indicates that the CTS (MSR Bit 4) has changed state since the last time it was read by the CPU.

Bit 1: This bit is the Delta Data Set Ready (DDSR) indicator. Bit 1 indicates that the DSR (MSR Bit 5) has changed state since the last time it was read by the CPU.

Bit 2: This bit is the Trailing Edge of Ring indicator. Bit 2 indicates that the RI (MSR Bit 6) has changed from a low to a high state.

Bit 3: This bit is the Delta Data Carrier Detect (DDCD) indicator. Bit 3 indicates that the DCD (MSR Bti 7) has changed state.

Note:Whenever bit 0, 1, 2 or 3 is set to a logic 1, a Modem Status Interrupt is generated.

Bit 4: This bit reflects the value of MSR Bit 4 (CTS).

Bit 5: This bit reflects the value of MSR Bit 5 (DSR).

Bit 6: This bit reflects the value of MSR Bit 6 (RI).

Bit 7: This bit reflects the value of MSR Bit 7 (DCD).

Scratch Register (SCR): Address 7

Reset State 00h

This 8-bit Read/Write Register does not control the UART in any way. It is intended as a Scratch Pad Register to be used by the programmer to hold data temporarily.

Divisor Latch (DLL): Address 0 (DLAB = 1)

Reset State 00h

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
DAT7	DAT6	DAT5	DAT4	DAT3	DAT2	DAT1	DAT0

This register contains baud rate information from the host PC. The PC sets the Divisor Latch Register values.

Divisor Latch (DLM): Address 1 (DLAB = 1)

Reset State 00h

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
DAT7	DAT6	DAT5	DAT4	DAT3	DAT2	DAT1	DAT0

This register contains baud rate information from the host PC.

Note:Two 8-bit latches (DLL-DLM) store the divisor in 16-digit binary format. The desired baud rate can be obtained by dividing the 115200Hz clock by the divisor.

Desired Baud Rate	Divisor Value
50	2304
75	1536
110	1047
150	768
300	384
600	192
1200	96
2400	48
4800	24
9600	12
19200	6
38400	3
57600	2
115200	1

10. Micro-controller Control Register for PCI interface

PCI Vender ID Low Byte Data Port: Address F800H (pci only)

Write only
This port configures PCI Vender ID low byte.(Offset 00 of PCI configuration register space)

PCI Vender ID High Byte Data Port: Address F801H (pci only)

Write only
This port configures PCI Vender ID high byte. (Offset 01 of PCI configuration register space)

PCI Device ID Low Byte Data Port: Address F802H

Write only
This port configures PCI Device ID low byte. (Offset 02 of PCI configuration register space)

PCI Device ID High Byte Data Port: Address F803H

Write only
This port configures PCI Device ID low byte.(Offset 00 of PCI configuration register space)

PCI Subsystem Vender ID Low Byte Data Port: Address F804H (pci only)

Write only
This port configures PCI Subsystem Vender ID low byte. (Offset 2C of PCI configuration register space)

PCI Subsystem Vender ID High Byte Data Port: Address F805H (pci only)

Write only
This port configures PCI Subsystem Vender ID high byte. (Offset 2D of PCI configuration register space)

PCI Subsystem Device ID Low Byte Data Port: Address F806H

Write only
This port configures PCI Subsystem Device ID low byte. (Offset 2E of PCI configuration register space)

PCI Subsystem Device ID High Byte Data Port: Address F807H

Write only
This port configures PCI Subsystem Device ID low byte. (Offset 2F of PCI configuration register space)

PCI Power Management New Capability: Address F808H, Bit 4 (pci only)

Write only
This bit configures if support PCI Power Management. (Offset 06 bit 4 of PCI configuration register space)

PCI Power Management Power State: Address F809H, Bit[1..0] (pci only)

Write / Read
These bits configures PCI Power management Power State. (Offset 54 bit [1..0] of PCI configuration register space)

PCI Power Management PME_STATUS: Address F80AH, Bit 1

Write only
This bit configures PCI Power status. (Offset 55 bit 7 of PCI configuration register space)

PCI Power Management PME_EN: Address F80AH, Bit 0

Write only
This bit configures PCI if enable PME wake up (Offset 55 bit 0 of PCI configuration register space)

PCI PME_D3_Support: Address F80BH, Bit 0

Write only
This port configures PCI if support PME wake up at D3 state. (Offset 53 bit [8..7] of PCI configuration register space)

11. PCI Configuration Register Definition

The definitions of PCI Configuration Registers are based on the PCI specification revision 2.1 and provides the initialization and configuration information to operate the PCI interface in the DM6588. All registers can be accessed with byte, word, or double word mode. As defined in PCI specification 2.1, read accesses to reserve or unimplemented registers will return a value of "0." These registers are to be described in the following sections.

PCI Configuration Registers Mapping :

Description	Identifier	Address Offset	Value of Reset
Identification	PCIID	00H	6588A1282H
Command & Status	PCICS	04H	04100001H
Revision	PCIRV	08H	07000210H
Miscellaneous	PCILT	0CH	00000000H
I/O Base Address	PCIIO	10H	XXXXXXXx001
Reserved	--------	14H - 28H	
Subsystem Identification	PCISID	2CH	undefined
Capability Pointer	CAP_PTR	34H	00000050H
Reserved	--------	38H	
Interrupt & Latency	PCIINT	3CH	281401XXH
Power Management Register	PMR	50H	00110001H
Power Management Control & Status	PMCSR	54H	00000000H

Configuration Register Structure

Device ID		Vendor ID		00H
Status (with bit 4 set to 1)		Command		04H
Class Code = 070002			Revisio	08H
BIST	Header Type	Latency Timer	Cach Line Size	0CH
Bass Address Register CBIO				10H
Reserved				14H
Reserved				18H 1CH 20H 24H 28H
Subsystem ID		Subsystem Vendor ID		2CH
Reserved				30H
Reserved			Cap_Ptr	34H
Reserved				38H
Max_Lat	Min_Gnt	Interrupt Pin = 1	Interrupt Line	3CH
Reserved				40H
Reserved				44H 48H 4CH
Power Management Capability		Next Item Pointer	Capability ID	50H
Reserved		Power Management Control and Status		54H

Key to Default

In the register description that follows, the default column takes the form <Reset Value>
Where：

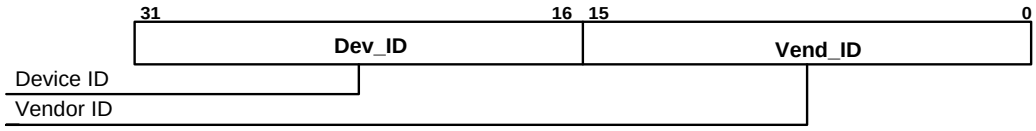
<Reset Value>:

1 Bit set to logic one
0 Bit set to logic zero
X No default value

<Access Type>:

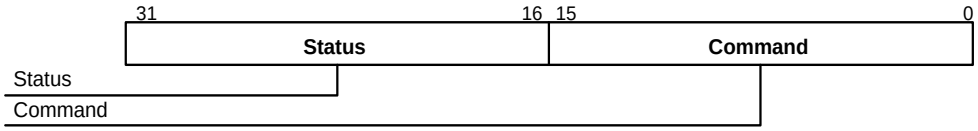
RO = Read only
RW = Read/Write
R/C: means Read / Write & Write "1" for Clear.
_WR = Controller Write
_RD = Controller Read

Identification ID (xxxxxx00 - PCIID)

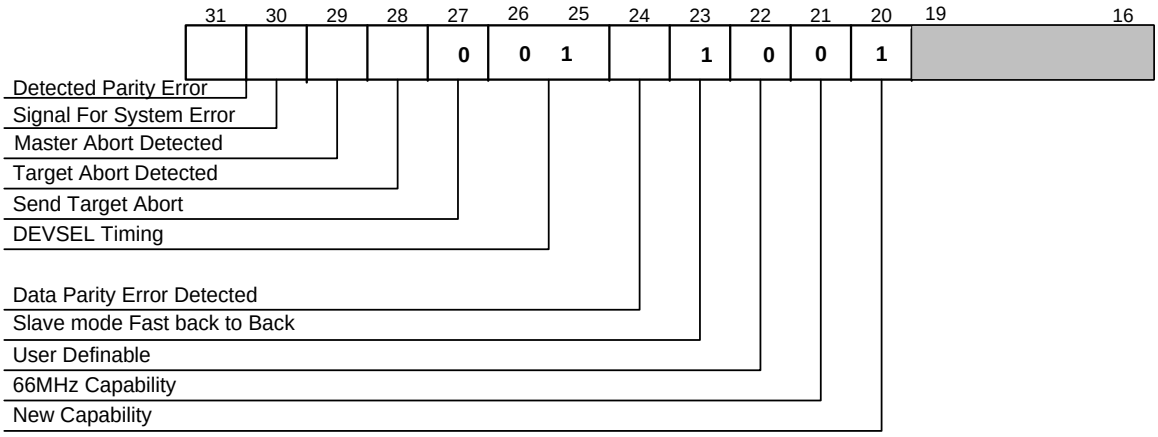


Bit	Default	Type	Description
31:16	6588Ah	RO _WR	The field identifies the particular device. Unique and fixed number for the DM6588 is 6588Ah. It is the product number assigned by DAVICOM.
15:0	1282h	RO _WR	This field identifies the manufacturer of the device. Unique and fixed number for Davicom is 1282h. It is a registered number from SIG.

Command & Status (xxxxxx04 - PCICS)

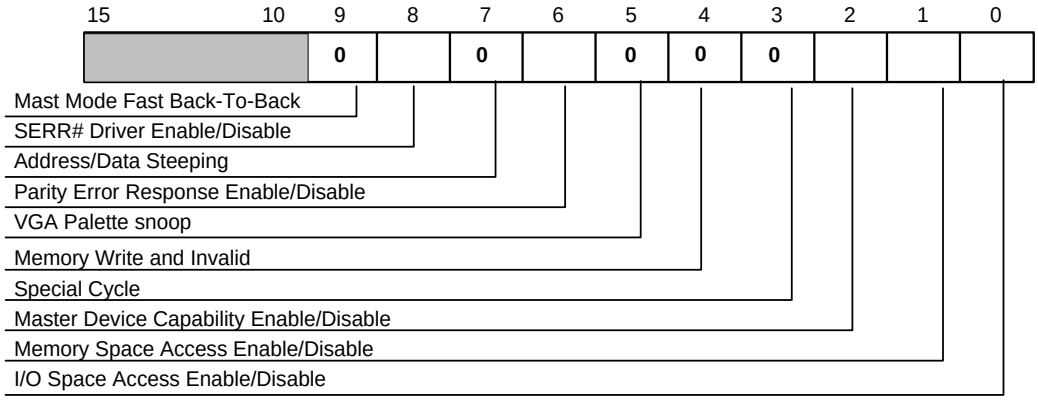


Status Register Definition:


31 30 29 28 27 26 25 24 23 22 21 20 19 16
0 0 1 1 0 0 1
Detected Parity Error
Signal For System Error
Master Abort Detected
Target Abort Detected
Send Target Abort
DEVSEL Timing
Data Parity Error Detected
Slave mode Fast back to Back
User Definable
66MHz Capability
New Capability

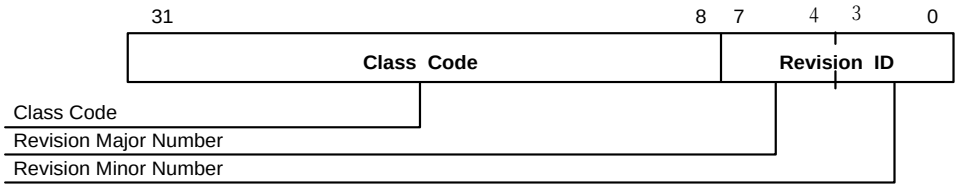
Bit	Default	Type	Description
31	0	R/C	**Detected Parity Error** The DM6588 samples the AD[0:31], C/BE[0:3]#, and the PAR signal to check parity and to set parity errors.
30	0	R/C	**Signaled System Error** This bit is set when the SERR# signal is driven by the DM6588. This system error occurs when an address parity is detected under the condition that bit 8 and bit 6 in command register below are set.
29	0	R/C	**Master Abort Detected** The DM6588 will never support the function
28	0	R/C	**Target Abort Detected** The DM6588 will never support the function
27	0	RO	**Send Target Abort** (0 For No Implementation) The DM6588 will never support the function.
26:25	10	RO	**DEVSEL Timing** (10 Select Slow Timing) Slow timing of DEVSEL# means the DM6588 will assert DEVSEL# signal two clocks after FRAME# is sample "asserted."
24	0	R/C	**Data Parity Error Detected** The DM6588 will never support the function
23	0	RO	**Slave mode Fast Back-To-Back Capable** (1 For Good Capability) The DM6588 will never support the function
22	0	RO	**User-Definable-Feature Supported** (0 For No Support)
21	0	RO	**66 MHz Capable** (0 For No Capability)
20	1	RO _WR	**New Capabilities** This bit indicates whether this function implements a list of extended capabilities such as PCI power management. When set this bit indicates the presence of New Capabilities. A value of 0 means that this function does not implement New Capabilities.
19:16	0000	RO	Reserved

Command Register Definition:



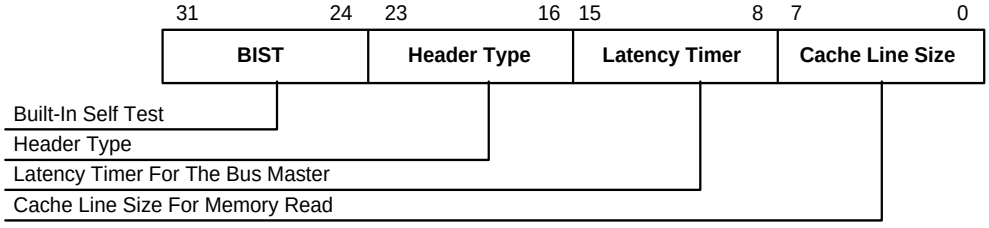
Bit	Default	Type	Description
15:10	000000	RO	Reserved
9	0	RO	**Master Fast Back-to-back Mode** (0 For No Support) The DM6588 does not support master mode fast back-to-back capability and will not generate fast back-to-back cycles.
8	0	RW	**SERR# Driver Enable/Disable** This bit controls the assertion of SERR# signal output. The SERR# output will be asserted on detection of an address parity error and if both this bit and bit 6 are set.
7	0	RO	**Address/Data Stepping** (0 For No Stepping)
6	0	RW	**Parity Error Response Enable/Disable** Setting this bit will enable the DM6588 to assert PERR# on the detection of a data parity error and to assert SERR# for reporting address parity error.
5	0	RO	**VGA Palette Snooping** (0 For No Support)
4	0	RO	**Memory Write and Invalid** (0 For No Support)
3	0	RO	**Special Cycles** (0 For No Implementation)
2	0	RW	**Master Device Capability Enable/Disable** The DM6588 will never support the function.
1	0	RW	**Memory Space Access Enable/Disable** The DM6588 will never support the function.
0	1	RW	**I/O Space Access Enable/Disable** This bit controls the ability of I/O space access.

Revision ID (xxxxxx08 - PCIRV)



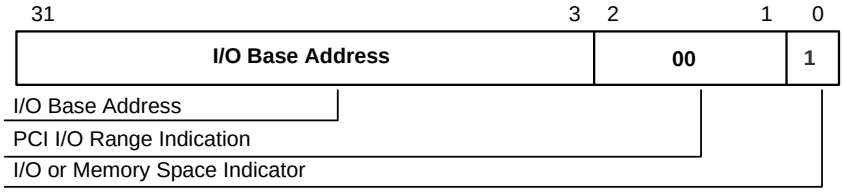
Bit	Default	Type	Description
31:8	070002h	RO	**Class Code** (070002h) This is the standard code for Simple Communications controller.16550 compatible serial controler.
7:4	0001	RO	**Revision Major Number** This is the silicon-major revision number that will increase for the subsequent versions of the DM6588
3:0	0000	RO	**Revision Minor Number** This is the silicon-minor revision number that will increase for the subsequent versions of the DM6588.

Miscellaneous Function (Xxxxxx0c - PCILT)



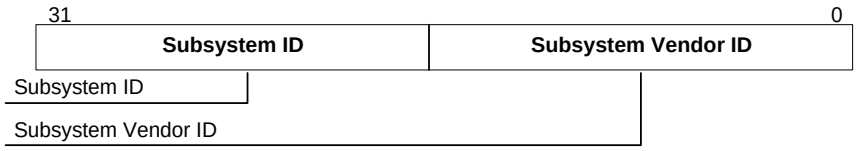
Bit	Default	Type	Description
31:24	00h	RO	**Built-In Self Test** (=00h Means No Implementation)
23:16	00h	RO	**Header Type** (= 00h Means single function with Predefined Header Type)
15:8	00h	RO	**Latency Timer For The Bus Master**. The DM6588 will never support the function.
7:0	00h	RO	**Cacheline Size For Memory Read Mode Selection** (00h Means No Implementation For Use)

I/O Base Address (Xxxxxx10 - PCIIO)



Bit	Default	Type	Description
31:3	Undefined	RW	**PCI I/O Base Address** This is the base address value for I/O access cycles. It will be compared to AD[31:3] in the address phase of bus command cycle for the I/O resource access.
2:1	00	RO	**PCI I/O Range Indication** It indicates that the minimum I/O resource size is 08h.
0	1	RO	**I/O Space Or Memory Space Base Indicator** Determines that the register maps into the I/O space.(=1 Indicates I/O Base)

Subsystem Identification (Xxxxxx2c - PCISID)



Bit	Default	Type	Description
31:16	XXXXh	RO _WR	**Subsystem ID** Node number loaded from Contriller and different from each card.
15:0	XXXXh	RO _WR	**Subsystem Vendor ID** Unique number given by PCI SIG and loaded from Controller.

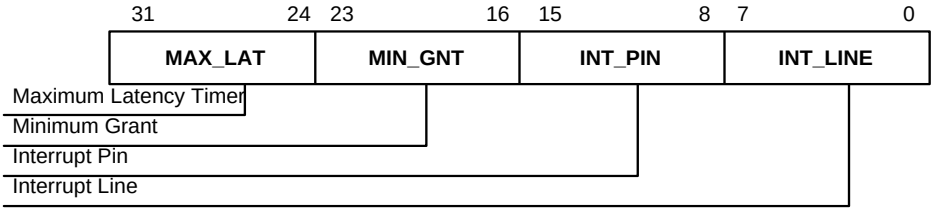
Capabilities Pointer (Xxxxxx34 - Cap _Ptr)

Cap_Ptr

0	1	0	1	0	0	0	0	Offset 34H
7							0	

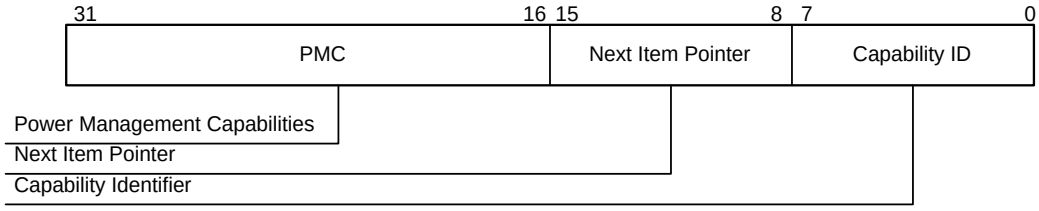
Bit	Default	Type	Description
31:8	000000h	RO	Reserved
7:0	01010000	RO	**Capability Pointer** The Cap_Ptr provides an offset (default is 50h) into the function's PCI Configuration Space for the location of the first term in the Capabilities Linked List. The Cap_Ptr offset is DOUBLE WORD aligned so the two least significant bits significant bits are always "0"s

Interrupt & Latency Configuration (Xxxxxx3c - PCIINT)



Bit	Default	Type	Description
31:24	28h	RO	**Maximum Latency Timer** that can be sustained (Read Only and Read As 28h)
23:16	14h	RO	**Minimum Grant** Minimum Length of a Burst Period (Read Only and Read As 14h)
15:8	01h	RO	**Interrupt Pin** read as 01h to indicate INTA#
7:0	XXh	RW	**Interrupt Line** that Is Routed to the Interrupt Controller

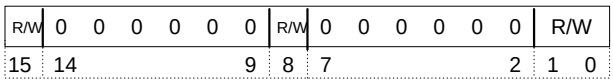
Power Management Register (Xxxxxx50h~PMR)



Bit	Default	Type	Description
31:27	00000	RO _WR	PME_Support This five-bit field indicates the power states in which the function may assert PME#. A value of 0 for any bit indicates that the function is not capable of asserting the PME# signal while in that power state. bit27 → PME# support D0 bit28 → PME# support D1 bit29 → PME# support D2 bit30 → PME# support D3(hot) bit31 → PME# support D3(cold) DM6588's bit31~27=11000 indicates PME# can be asserted from D3(hot) & D(cold).
26:22	00000	RO	Reserved (DM6588 not supports D1, D2)
21	0	RO	A "1" indicates that the function requires a device specific initialization sequence following transition to the D0 uninitialized state.
20	1	RO	Auxiliary Power Source This bit is only meaningful if bit31 is a "1". This bit is "1" in DM6588 indicates that support for PME# in D3(cold) requires auxiliary power.
19	0	RO	PME# Clock "0" indicates that no PCI clock is required for the function to generate PME#.
18:16	001	RO	Version A value of 001 indicates that this function complies with the Revision 1.0 of the PCI Power Management Interface Specification.
15:8	00h	RO	Next Item Pointer The offset into the function's PCI Configuration Space pointing to the location of next item in the function's capability list is "00h"
7:0	01h	RO	Capability Identifier When "01h" indicates the linked list item as being the PCI Power Management Registers.

Power Management Control/Status(Xxxxxx54h~PMCSR)

PMCSR



Offset=54H

Bit	Default	Type	Description
31:16	0000h	RO	Reserved
15	0	R/C _WR	**PME_Status** This bit is set when the function would normally assert the PME# signal independent of the state of the PME_En bit. Writing a “1” to this bit will clear it. This bit defaults to “0” if the function does not support PME# generation from D3(cold). If the function supports PME# from D3(cold) then this bit is sticky and must be explicitly cleared by the operating system each time the operating system is initially loaded.
14:9	000000	RO	Reserved. It means that the DM6588 does not support reporting power consumption.
8	0	RW _WR	**PME_En** Write “1” to enables the function to assert PME#, write “0” to disable PME# assertion. This bit defaults to “0” if the function does not support PME# generation from D3(cold). If the function supports PME# from D3(cold) then this bit is sticky and must be explicitly cleared by the operating system each time the operating system is initially loaded.
7:2	000000	RO	Reserved
1:0	00	RW _WR _RD	**Power State**. This two bits field is both used to determine the current power state of a function and to set the function into a new power state. The definitionis given below. 00 : D0 11 : D3(hot)

PCI function power management state
The DM6588 supports PCI function power states D0, D3(hot), D3(cold). Additional PCI signal PME# to pin A19 of the standard PCI connector.

PME Context
PME (power Management Event) context is defined as the functional state information and logic required to generate power management events(PMEs), report PME status, and enable PMEs.
For MODEM, PME context consists of **PME_En** bit, **PME_Status** bit , **Ring Detec**t ,and **Ring to PME** circuit.

PCI MODEM Power Management Operation
During a true power-on situation (no auxiliary and normal power), PME_En = 0 to avoid to assert PME#. When assert RST#, the pci configuration space is set to default value except PME context which must preserve.

DM6588 can not assert PME# from D0. But can Assert PME# from D3(hot) and D3(cold). Hence the Ring to PME# circuit must check the power state. If ring comes at D0 power state, it can not assert PME#.

Software will enable its use by setting the PME_En bit in the PMCSR.
It must continue to assert PME# until software either clears the PME_En bit or clears the PME_Status bit.
Before enter D3(cold) state, host must :

1. Write 1 into PME_Status bit to clear previous PME status
2. Write 1 into PME_En bit to enable PME function.
3. Write 3 into Power_state
4. Power off PCI bus.

When Ring comes, Ring to PME# circuit check if PME_EN=1 and Power_staus <>0. If yes, assert PME# and set PME_Status=1.

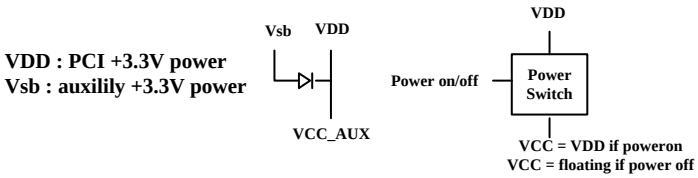
When host detect PME# asserted, it will power up PCI bus and assert RST# to initialize pci modem. At the same time, it write 1 into PME_En bit or PME_Status bit to stop PME#.

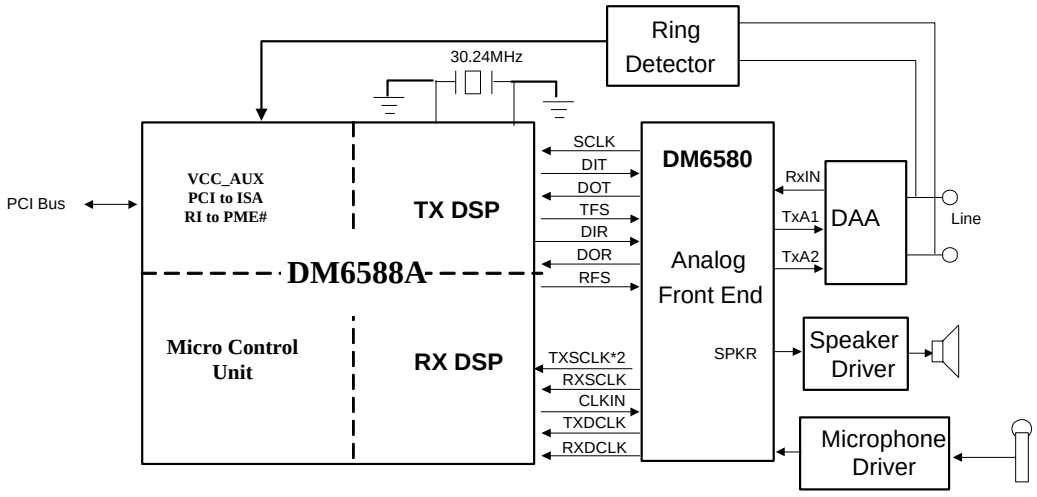
Before enter D3(hot) state, host must :

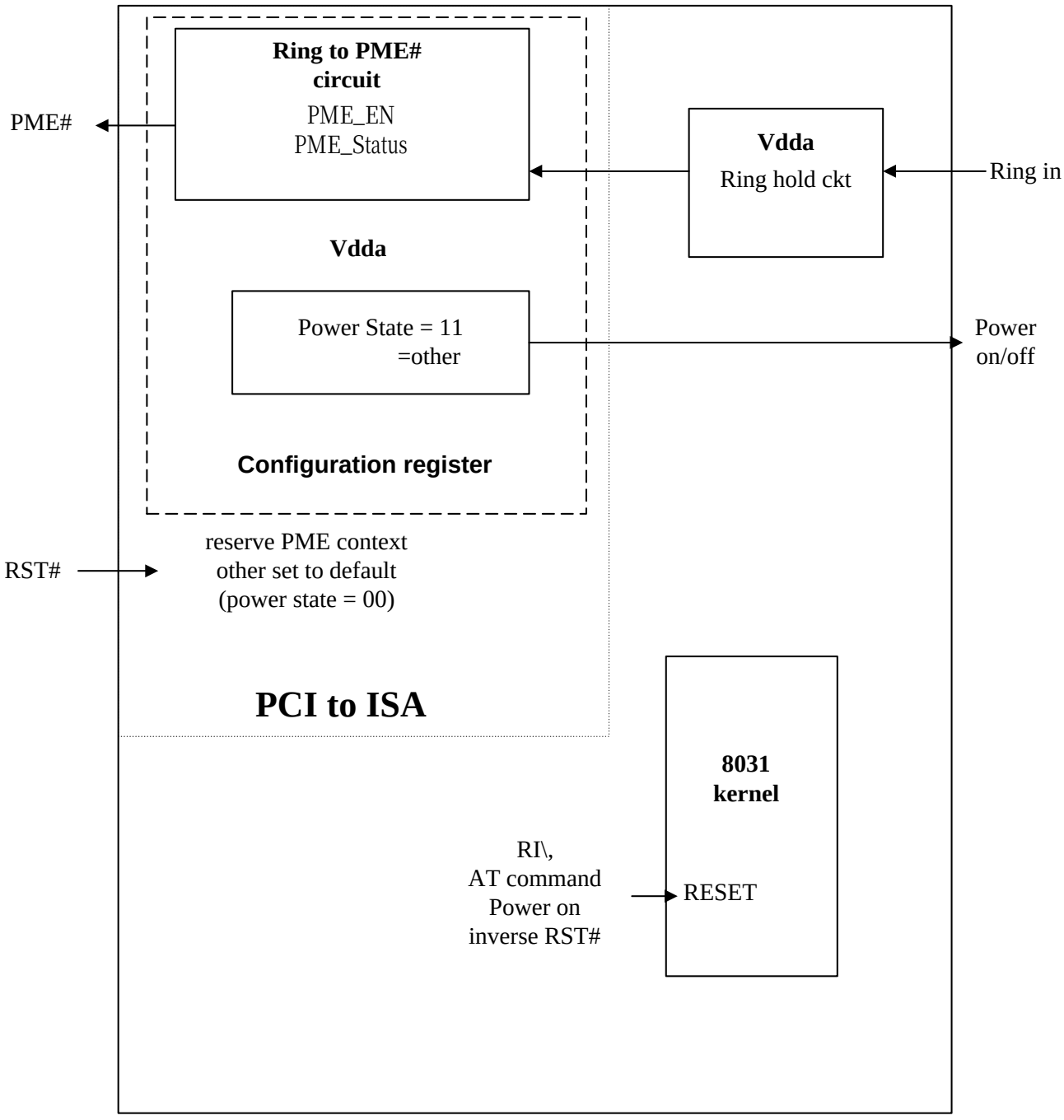
5. Write 1 into PME_Status bit to clear previous PME status
6. Write 1 into PME_En bit to enable PME function.
7. Write 3 into Power_state

When Ring come, Ring to PME# circuit check if PME_EN=1 and Power_staus <>0. If yes, assert PME# and set PME_Status=1.
When host detect PME# asserted, it will re-initialize pci modem and set Power_State=0 to return D0 state. At the same time, it write 1 into PME_En bit or PME_Status bit to stop PME#.

PCI MODEM Board Power Management







DM6588 PCI Power Configuration

DM6588 External Electrical Characteristics

DM6588 External Absolute Maximum Ratings* (25°C)

Symbol	Parameter	Min.	Max.	Unit	Conditions
DVCC,AVCC	Supply Voltage	-0.3	3.6	V	
VIN	DC Input Voltage (VIN)	-0.5	5.5	V	
VOUT	DC Output Voltage(VOUT)	-0.3	3.6	V	
Tc	Case Temperature Range	0	85	°C	
Tstg	Storage Temperature Rang (Tstg)	-65	150	°C	
LT	Lead Temp. (TL, Soldering, 10 sec.)	---	220	°C	

***Comments**

Stresses above those listed under “Absolute Maximum Ratings " may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational section of this specification is not implied or intended. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

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DM6588 External DC Electrical Characteristics (VDD = 3.3V, GND = 0V; Tc = 0 ^{o}C to 85 ^{o}C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
VDD	Operating Voltage	3.15	3.3	3.45	V	
IDD	Operating Current		90		mA	
VIH	Input High Voltage	2.0			V	
VIL	Input Low Voltage			0.8	V	
IiL	Input Leakage Current	-1.0		1.0	µ A	VIN = 0, 3.45V
VOH	Output High Voltage	2.4			V	IOH = -0.5mA
VOL	Output Low Voltage			0.4	V	IOL = 1.5mA
CIN	Input Capacitance		10.0		pF	
VILRESET	Reset Schmitt VIL			0.8	V	
VIHRESET	Reset Schmitt VIH	2.8			V	

DM6588 ISA Electrical Characteristics

DM6588 ISA Absolute Maximum Ratings* (25°C)

Symbol	Parameter	Min.	Max.	Unit	Conditions
DVCC,AVCC	Supply Voltage	-0.3	3.6	V	
VIN	DC Input Voltage (VIN)	-0.5	5.5	V	
VOUT	DC Output Voltage(VOUT)	-0.3	3.6	V	
Tc	Case Temperature Range	0	85	°C	
Tstg	Storage Temperature Rang (Tstg)	-65	150	°C	
LT	Lead Temp. (TL, Soldering, 10 sec.)	---	220	°C	

***Comments**

Stresses above those listed under “Absolute Maximum Ratings " may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational section of this specification is not implied or intended. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

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DM6588 ISA DC Electrical Characteristics (VDD = 3.3V, GND = 0V; Tc = 0 ^{O}C to 85 ^{O}C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
VDD	Operating Voltage	3.15	3.3	3.45	V	
IDD	Operating Current		90		mA	
VIH	Input High Voltage	2.0			V	
VIL	Input Low Voltage			0.8	V	
IiL	Input Leakage Current	-1.0		1.0	μA	VIN = 0, 3.45V
VOH	Output High Voltage	2.4			V	IOH = -0.5mA
VOL	Output Low Voltage			0.4	V	IOL = 1.5mA
CIN	Input Capacitance		10.0		pF	
VILRESET	Reset Schmitt VIL			0.8	V	
VIHRESET	Reset Schmitt VIH	2.8			V	

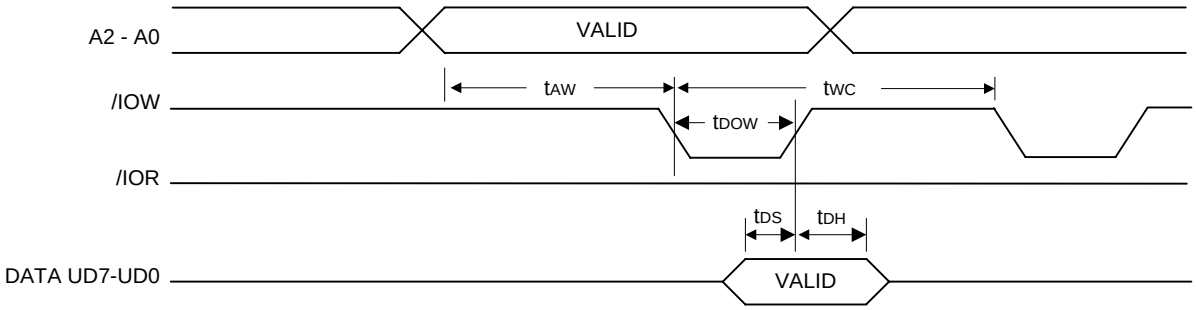
DM6588 ISA AC Electrical Characteristics & Timing waveforms

DM6588 ISA AC Electrical Characteristics (VDD = 3.3V, GND = 0V; TA = 25 ^{O}C)

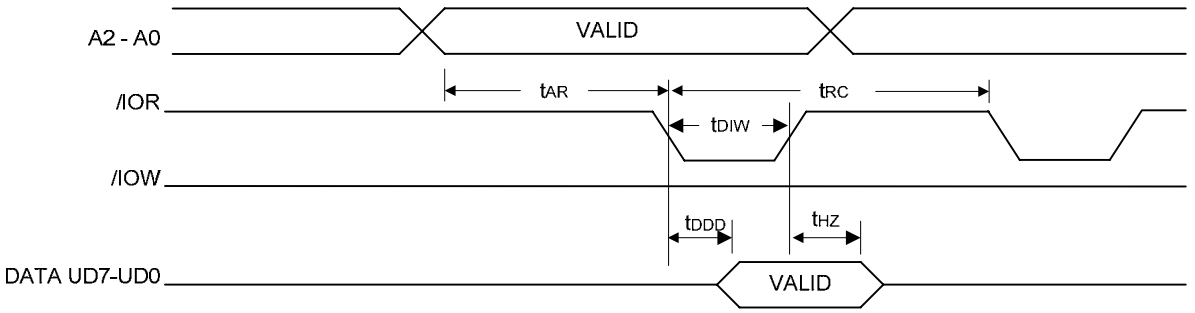
Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
tAW	IOW Delay from Address	5			ns	
tWC	Write Cycle	106			ns	
tDOW	IOW Strobe Width	22			ns	
tDS	Data Setup Time	22			ns	
tDH	Data Hold Time	5			ns	
tAR	IOR Delay from Address	5			ns	
tRC	Read Cycle	102			ns	
tDIW	IOR Strobe Width	22			ns	
tDDD	Delay from IOR to Data Valid			30	ns	100pF loading
tHZ	IOR to Floating Data Delay			20	ns	100pF loading

DM6588 ISA signals Timing Diagrams

Write Cycle



Read Cycle



DM6588 PCI Electrical Characteristics

DM6588 PCI Absolute Maximum Ratings* (25°C)

Symbol	Parameter	Min.	Max.	Unit	Conditions
DVCC,AVCC	Supply Voltage	-0.3	3.6	V	
VIN	DC Input Voltage (VIN)	-0.5	5.5	V	
VOUT	DC Output Voltage(VOUT)	-0.3	3.6	V	
Tc	Case Temperature Range	0	85	°C	
Tstg	Storage Temperature Rang (Tstg)	-65	150	°C	
LT	Lead Temp. (TL, Soldering, 10 sec.)	---	220	°C	

***Comments**

Stresses above those listed under “Absolute Maximum Ratings " may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational section of this specification is not implied or intended. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

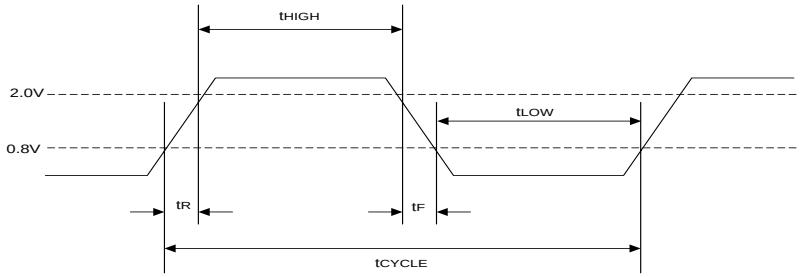
DM6588 PCI DC Electrical Characteristics (V_{DD} = 3.3V, GND = 0V; Tc = 0 ^{o}C to 85 ^{o}C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
VDD	Operating Voltage	3.15	3.3	3.45	V	
IDD	Operating Current		120		mA	
VIH	Input High Voltage	2.0			V	
VIL	Input Low Voltage			0.8	V	
IiL	Input Leakage Current	-1.0		1.0	µA	VIN = 0, 3.45V
VOH	Output High Voltage	2.4			V	IOH = -0.5mA
VOL	Output Low Voltage			0.4	V	IOL = 1.5mA
CIN	Input Capacitance		10.0		pF	
VILRESET	Reset Schmitt VIL			0.8	V	
VIHRESET	Reset Schmitt VIH	2.8			V	

DM6588 PCI AC Electrical Characteristics & Timing Waveforms

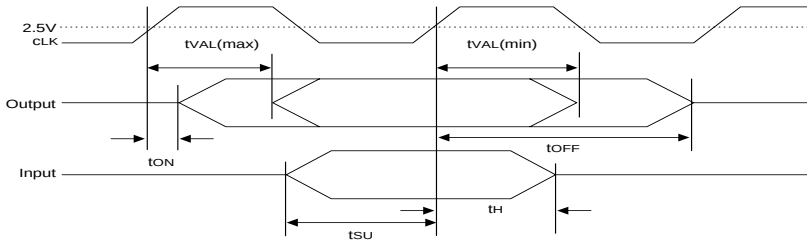
(V_{DD} = 3.3V, G_{ND} = 0V; Tc = 0℃ to 85℃)

PCI Clock Specifications Timing



Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
tR	PCI_CLK rising time	4	-	-	ns	-
tF	PCI_CLK falling time	4	-	-	ns	-
tCYCLE	Cycle time	30	-	-	ns	-
tHIGH	PCI_CLK High Time	12	-	-	ns	-
tLOW	PCI_CLK Low Time	12	-	-	ns	-

Other PCI Signals Timing Diagram



Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
tVAL	Clk-To-Signal Valid Delay	2	-	12	ns	Cload = 50 pF
tON	Float-To-Active Delay From Clk	2	-	-	ns	-
tOFF	Active-To-Float Delay From Clk	-	-	28	ns	-
tSU	Input Signal Valid Setup Time Before Clk	7	-	-	ns	-
tH	Input Signal Hold Time From Clk	5	-	-	ns	-

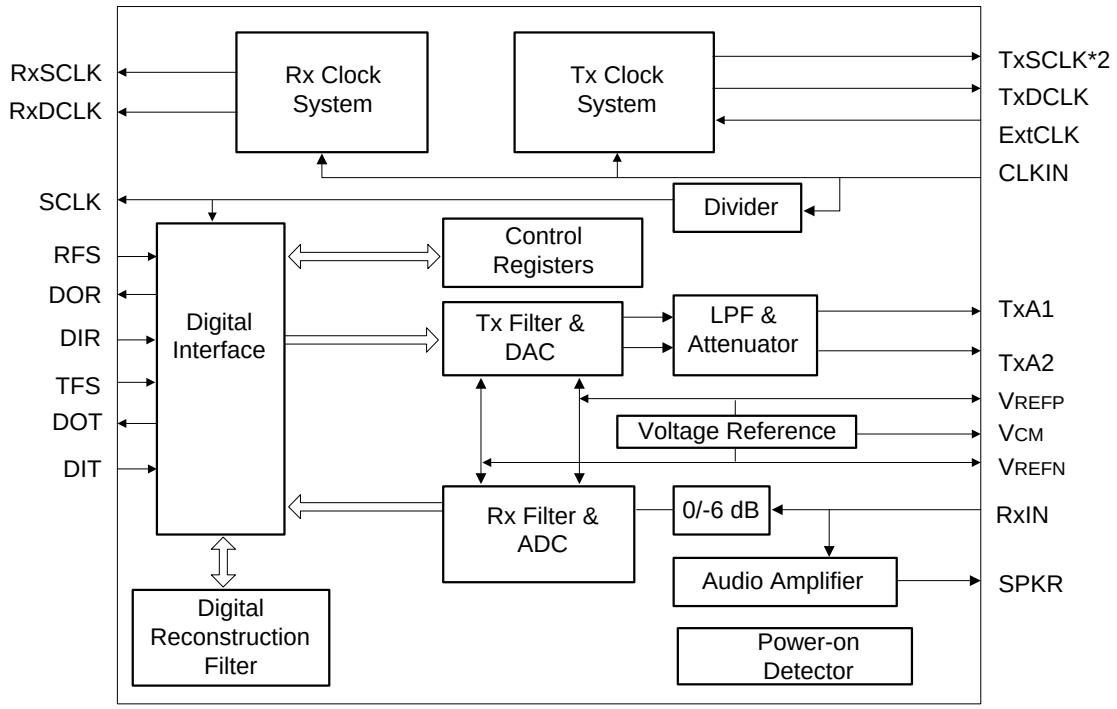
Chip 2 : DM6580 Analog Front End

DM6580 Description

The DM6580 is a single chip Analog Front End (AFE) designed to be implemented in voice grade modems for data rates up to 56000bps. The DM6580 is an essential part the complete modem device set. The AFE converts the analog signal into digital form and transfers the digital data to the DSP through the serial port. All the clock information needed in a modem device is also generated in the DM6580. Differential analog outputs are provided to achieve the maximum output signal level. An audio monitor with programmable volume levels is built in to monitor the on-line signal. Inside the device, a 16-bit ADC and a 16-bit DAC with over-sampling and noise-shaping techniques is implemented to maximize performance.

The DM6580 offers wide-band transmit and receive filters so that the voice band signal is transmitted or received without amplitude distortion and with minimum group delay. In order to support multi-mode modem standards, such as V.90, V.34+, V.32bis, V.32, V.22bis, V.22, V.23, V.21, Bell 212A, Bell 103, V.17, V.29, V.27ter, programmable baud and data rate clock generators are provided. For asymmetric channel usage, the transmit and receive clock generators are independent. In order to enhance echo-cancellation, the receive clock is synchronized with the transmit clock and the best receive timing sample is reconstructed by a reconstruction filter. The Transmit Digital Phase Lock Loop (DPLL) is self-tuning to provide a master, slave or free-running mode for the data terminal interface. A receive DPLL that is step programmable by the host DSP is implemented to get the best samples for the relevant signal processing.

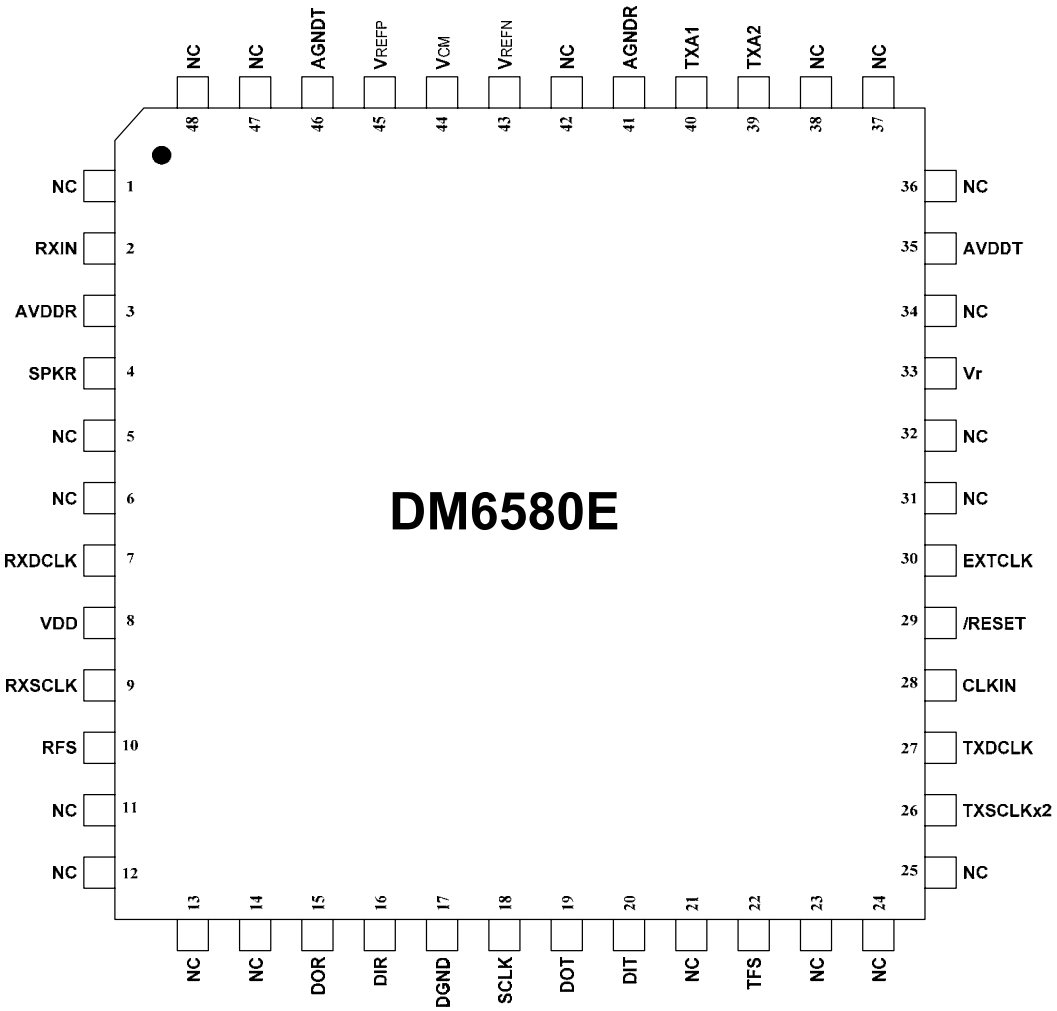
DM6580 Block Diagram



DM6580 Features

- 16-bit Σ-△ A/D and D/A converters
- Dynamic range : 86dB
- Total harmonic distortion : -86dB
- Separate transmit and receive clocks
- Symbol rate : 75, 300, 600, 1200, 1600, 2400, 2743, 2800, 3000, 3200, 3429, 8000Hz
- Data rate V.34 : 75, 300, 600, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, 28800, 31200, 33600 bps
- Data rate V.90 : up to 56000 bps
- Dual synchronous serial interface to host Digital Signal Processor (DSP)
- Separate transmit digital phase lock loop and receive digital phase lock loop
- Full echo cancellation capability
- Differential analog output
- Single-ended analog input
- Single power supply voltage : +5V
- Low power consumption

DM6580 Pin Configuration



DM6580 Pin Description

Pin No. 48pin LQFP	Pin Name	I/O	Description
2	RXIN	I	Receive Analog Input
3	AVDDR	I	Analog V_{DD} For The Receiver Analog Circuitry (+5V_{DC})
4	SPKR	O	Speaker Driver
7	RXDCLK	O	Receive Data Clock
8	V_{DD}	P	Digital Power
9	RXSCLK	O	Receive Sample Clock
10	RFS	I	Receive Frame Synchronization
15	DOR	O	Data Output For Receiver
16	DIR	I	Data Input For Receiver
17	DGND	P	Digital Ground
18	SCLK	O	Serial Clock Synchronized With All Serial Data
19	DOT	O	Data Output For Transmitter
20	DIT	I	Data Input For Transmitter
22	TFS	I	Transmit Frame Synchronization
26	TXSCLK*2	O	Transmit Sample Clock * 2
27	TXDCLK	O	Transmit Data Clock
28	CLKIN	I	Master Clock Input (20.16MHz = 40.32MHz / 2)
29	/RESET	I	Codec Reset Input
30	EXTCLK	I	External Transmit Data Clock
33	Vr	O	Internal Reference Voltage. Connect 0.1uF to DGND
35	AVDDT	I	Analog V_{DD} For The Transmitter Analog Circuitry (+5V_{DC})
39	TXA2	O	Transmit Negative Analog Output
40	TXA1	O	Transmit Positive Analog Output
41	AGNDR	P	Analog Receiver Circuitry Signal Return Path
43	V_{REFN}	O	Negative Reference Voltage, V_{CM} - 1V
44	V_{CM}	O	Common Mode Voltage Output, 2.5V
45	V_{REFP}	O	Positive Reference Voltage, V_{CM} + 1V
46	AGNDT	P	Analog Transmitter Circuitry Signal Return Path
1,5,6, 11,12,13, 14,21,23, 24,25,31, 32,34,36, 37,38,42, 47,48	NC	N	NC

DM6580 Functional Description

In this chip, we could roughly divide it into two major parts: digital portion and analog portion. The functional blocks are described separately in this section. The analog circuits include a sigma-delta modulator/demodulator, decimation/interpolation filters, a speaker driver, low-pass filter and certain logic circuits. The digital circuits is composed of Tx/Rx clock generator/PLL, serial port, serial/parallel conversions and control registers. All the clock information the analog circuits need should be provided by the digital clock system since the best sampling instant of A/D and D/A depends on the received signal and transmit signals. The data format of A/D and D/A is 2's complement.

The master clock (FQ) is obtained from an external signal connected to CLKIN. The different transmit and receive clocks are obtained by master clock frequency division in several programmable counters. The Tx and Rx clocks can be synchronized on external signals by performing the phase shifts in the frequency division process. Two independent digital phase locked loops are implemented using this principle, one for transmit clock system, the other, receive clock. The tracking of the transmit clock is automatically done by the transmit DPLL circuit. The receive DPLL circuit is controlled by the host processor and it is actually an adjustable phase shifter.

DM6580 Register Description

Register	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Programmed Functions
TxCR0	R1	X3	X2	X1	X0	N3	N2	N1	N0	R0	S	T	Tx Data Rate Clock
TxCR1			Q1	D	M1	M0	Q0	F	Y	U2	U1	U0	Tx Baud sample Clock
TxCR2		Vol1	Vol2	F1	F0	W	ATT	LTX	LC	SST	EMX	VF	Miscellaneous control
TxTest													Reserved
RxCR0	R1		H2	H1	H0	N3	N2	N1	N0	R0	S	T	Rx Data Rate Clock
RxCR1		Q1	RST	D	M1	M0	Q0	P	Y	U2	U1	U0	Rx Baud SampleClock
RxCR2			-6dB	LL	PS4	PS3	PS2	PS1	PS0	AP2	AP1	AP0	Rx Phase Shift Control
RxTest													Reserved

DM6580 Absolute Maximum Ratings*

Absolute Maximum Ratings* (25°C)

Symbol	Parameter	Min.	Max.	Unit	Conditions
DVCC,AVCC	Supply Voltage	-0.5	7.0	V	
VIN	DC Input Voltage (VIN)	-0.5	5.5	V	
VOUT	DC Output Voltage(VOUT)	-0.5	5.5	V	
Tc	Case Temperature Range	0	85	°C	
Tstg	Storage Temperature Rang (Tstg)	-65	150	°C	
LT	Lead Temp. (TL, Soldering, 10 sec.)	---	235	°C	

***Comments**

Stresses above those listed under "Absolute Maximum Ratings " may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational section of this specification is not implied or intended. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

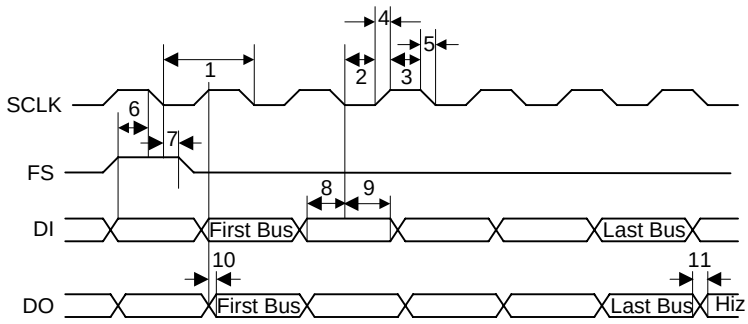
DM6580 DC Electrical Characteristics & Timing Waveforms (VDD = 5V, Tc = 0 °C to 85 °C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
VDD	Operating Voltage	4.75	5	5.25	V	
VCM	Output Common Mode Voltage		2.5		V	
IDD	Supply Current		25		mA	
VIL	Input Low Voltage			0.8	V	
VIH	Input High Voltage	2.0			V	
VOL	Output Low Voltage			0.4	V	
VOH	Output High Voltage	2.4			V	
IiL	Input leakage Current	-2.0	±1.0	2.0	μA	VI=0V,5.25V
CIN	Input Capacitance		5.0		pF	
VREF	Differential Reference Voltage Output	1.9	2.0	2.1	V	
VCMD_OUT	Output Common Mode Offset	-200		200	mV	=(TxA1+TxA2)/2-VCM
VDIF_OUT	Differential Output Voltage		3 *VREF		V	TxA1-TxA2 ≤ 3*VREF
VOFF_OUT	Differential Output DC Offset Voltage	-100		100	mV	VDC (TXA1)-VDC (TXA2)
RIN	Input Resistance RxIN	100			kΩ	
ROUT	Output Resistance TxA1, TxA2, SPKR		1	2	kΩ	
RL	Load Resistance TxA1, TxA2, SPKR	20			kΩ	
CL	Load Capacitance TxA1, TxA2, SPKR			50	pF	

DM6580 AC Characteristics & Timing Waveforms (V_{DD} = 5V, Tc= 0 °C to 85 °C)

Serial Port Timing

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
1	SCLK Period	49			ns	
2	SCLK Low Width	24			ns	
3	SCLK High Width	24			ns	
4	SCLK Rise Time			5	ns	
5	SCLK Fall Time			5	ns	
6	FS To SCLK Setup	17			ns	
7	FS To SCLK Hold	17			ns	
8	DI To SCLK Setup	5			ns	
9	DI To SCLK Hold	5			ns	
10	SCLK High To DO Valid			8	ns	
11	SCLK To DO Hiz			8	ns	



DM6580 Performance

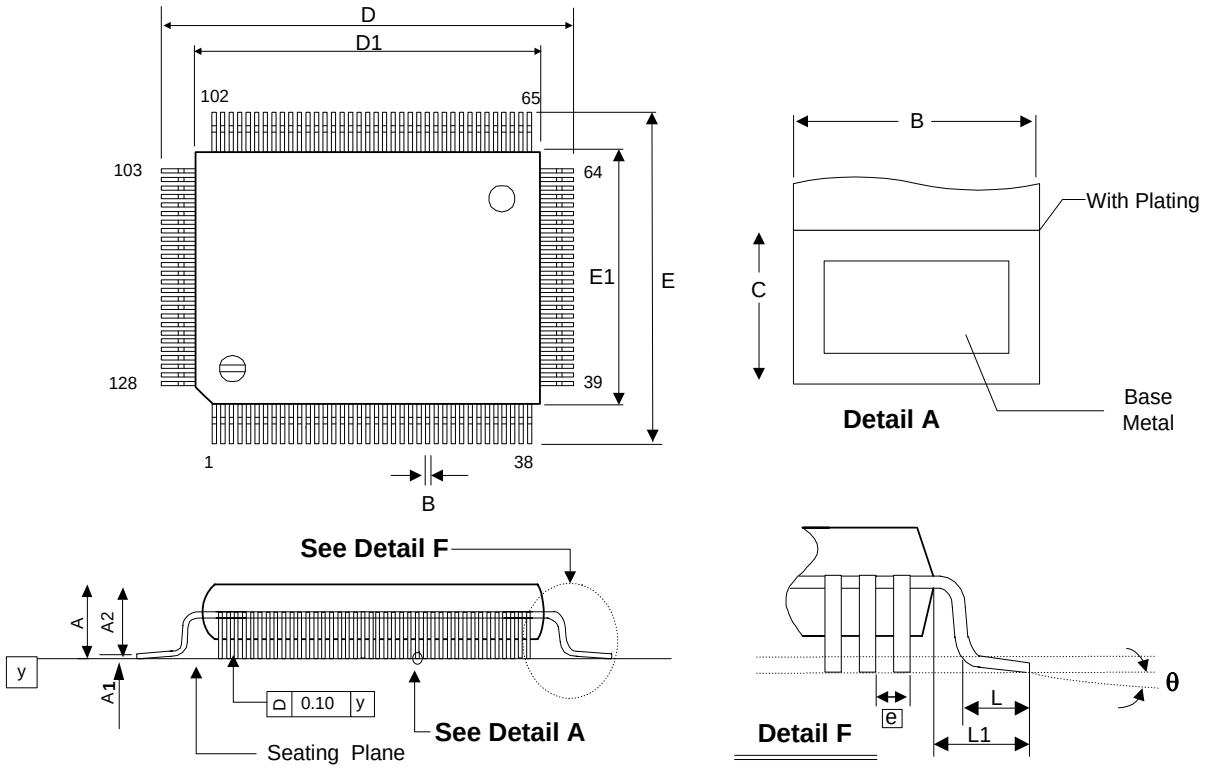
(V_{DD}= 5V, Tc= 0°C to 85°C, FQ= 20.16MHz, Measurement Band = 220Hz to 3.6KHz, RX DPLL Free Running)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
Gabs	Absolute Gain At 1KHz	-0.5		0.5	dB	Rx signal: V_{IN}= 2.5 V_{PP}, f = 1KHz
THD	Total Harmonic Distortion		-84		dB	Tx signal: $V_{OUT\ (diff)}$= 5 V_{PP}, f = 1KHz
DR	Dynamic Range		86		dB	f = 1KHz
PSRR	Power Supply Rejection Ratio		50		dB	f = 1KHz, V_{AC} = 200m V_{PP}
CTxRx	Crosstalk		95		dB	Transmit channel to receive channel

Package Information

QFP 128L Outline Dimensions **Unit:**

Inches/mm

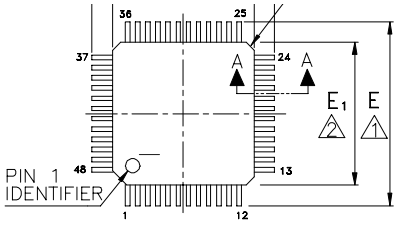


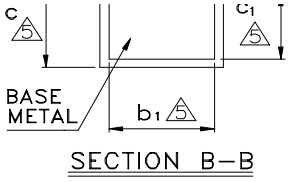
Symbol	Dimension In Inch	Dimension In mm
A	0.134 Max.	3.40 Max.
A1	0.010 Min.	0.25 Min.
A2	0.112± 0.005	2.85± 0.12
B	0.009± 0.002	0.22±0.05
C	0.006± 0.002	0.145± 0.055
D	0.913± 0.007	23.20± 0.20
D1	0.787± 0.004	20.00 ± 0.10
E	0.677± 0.008	17.20± 0.20
E1	0.551± 0.004	14.00± 0.10
e	0.020 BSC	0.5 BSC
L	0.035± 0.006	0.88± 0.15
L1	0.063 BSC	1.60 BSC
y	0.004 Max.	0.10 Max.
θ	0°~12°	0°~12°

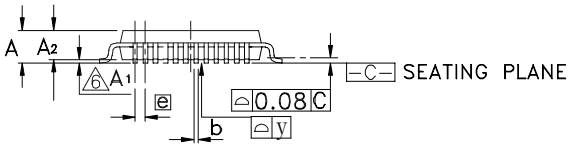
Note:

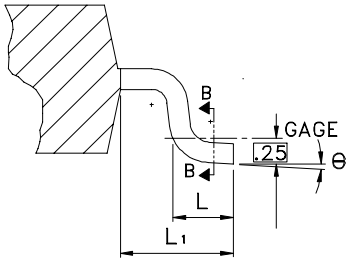
1. Dimension D1 and E1 do not include resin fins.
2. All dimensions are based on metric system.
3. General appearance spec. should base itself on final visual inspection spec.

LQFP 48L (F.P. 2mm) Outline Dimensions unit: inches/mm









Symbol	Dimensions in inches			Dimensions in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	0.063	-	-	1.60
A1	0.002	-	0.006	0.05	-	0.15
A2	0.053	0.055	0.057	1.35	1.40	1.45
b	0.007	0.009	0.011	0.17	0.22	0.27
b1	0.007	0.008	0.009	0.17	0.20	0.23
C	0.004	-	0.008	0.09	-	0.20
C1	0.004	-	0.006	0.09	-	0.16
D	0.354BSC			9.00BSC		
D1	0.276BSC			7.00BSC		
E	0.354BSC			9.00BSC		
E1	0.276BSC			7.00BSC		
e	0.020BSC			0.50BSC		
L	0.018	0.024	0.030	0.45	0.60	0.75
L1	0.039REF			1.00REF		
y	0.003MAX			0.08MAX		

θ	0-12°	0-12°

Notes:

1. To be determined at seating plane.
2. Dimensions D1 and E 1do not include mold protrusion. D1 and E1 are maximum plastic body size dimensions including mold mismatch.
3. Dimensions b does not include dambar protrusion. Total in excess of the b dimension at maximum material condition. Dambar cannot be located on the lower radius of the foot.
4. Exact shape of each corner is optional.
5. These dimensions apply to the flat section of the lead between 0.10mm and 0.25mm from the lead tip.
6. A1 is defined as the distance from the seating plane to the lowest point of the package body.
7. Controlling dimension: millimeter.
8. Reference documents: JEDEC MS-026, BBC.

Ordering Information

Part Number	Pin Count	Package
DM6580E	48	LQFP
DM6588F	128	QFP

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